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BOTANY.—*Two new genera of Acanthaceae from Guatemala.*[1] E. C. LEONARD, U. S. National Museum. (Communicated by WILLIAM R. MAXON.)

In the large collection of plants procured by Paul C. Standley on the 1939 Sewell Avery Expedition of the Field Museum of Natural History to Guatemala there were a number of interesting specimens of the family Acanthaceae. Represented in this material are two new genera, which are described herewith. One of these includes a species previously placed in the genus *Drejerella*.

Averia Leonard, gen. nov.

Sect. Odontonemineae. Calyx 5-partitus, tubo brevi, segmentis angustis; corolla subregularis, tubo gracili, lobis subaequalibus, obtusis vel rotunda-

Fig. 1.—*Averia serrata* Leonard: *a*, Portion of plant, natural size; *b*, bract; *c*, bractlet; *d*, calyx; *e*, stamen. (*b*, *c*, *d*, *e*, twice natural size.)

tis; stamina 2; antherae biloculares muticae, loculis parallelis, subaequaliter affixis; capsula stipitata, parva, 2- vel 4-sperma. Herbae; spicae terminales, densae; bracteae ovatae, imbricatae.

Type species, *Drejerella longipes* Standley.

This genus is closely related to *Drejerella* Lindau, but differs in its muticous, subequal, parallel anther cells. The anther cells of *Drejerella* are sub-

[1] Published by permission of the Secretary of the Smithsonian Institution. Received June 28, 1940.

superposed, the lowermost strongly calcarate. In both genera the pollen grains are of the "Spangenpollen" type, with a series of longitudinal grooves and an equatorial band of pores (three).

Fig. 2.—*Megalostoma viridescens* Leonard: *a*, Portion of branch; *b*, calyx (both natural size).

The name *Averia* is given in honor of Dr. Sewell Avery, director of the recent Field Museum expedition to Guatemala above mentioned.

Bracts serrate.....*A. serrata*
Bracts entire.....*A. longipes*

Averia serrata Leonard, sp. nov.

Herba, caulibus erectis vel adscendentibus, subteretibus, glanduloso-hirtellis; lamina foliorum ovata, apice subobtusa, apiculata, basi truncata, ser-

rata, glanduloso-hirtella; petioli tenues; spicae multae; bracteae acutae vel obtusae, apiculatae, serratae, glanduloso-hirtellae; bracteolae linearilanceolatae, glanduloso-pilosae; calycis segmenta lanceolata, glanduloso-hirtella; corolla glabra, ochroleuca; capsula glabra; semina plana, muricata.

Branched herbs, suffrutescent at base; stems erect or ascending, up to 20 cm long or more, subterete, glandular-hirtellous or the older parts glabrate; leaf blades ovate, 8 mm long, 6 mm wide, obtusish and minutely apiculate at apex, truncate at base, serrate, glandular-hirtellous; petioles slender, about 5 mm long, glandular-pilose; spikes numerous, up to 2.5 cm long and 1 cm in diameter; bracts closely imbricate, rhombic, up to 5 mm long, 3 to 4.5 mm wide, acute or obtuse at apex, minutely apiculate, narrowed at base to a short petiole (2 mm long, 1 mm wide), serrate, with one to three teeth on each side, 3-nerved, glandular-hirtellous; bractlets linear-lanceolate, 6 mm long, 1 mm wide, densely glandular-pilose; calyx 5-parted, the segments lanceolate, 3.5 mm long, 0.5 mm wide, glandular-hirtellous; corolla about 8 mm long, glabrous, cream-colored, the tube 3 mm long, slender, the segments (4) obovate, subequal, 3 to 3.5 mm wide toward apex, obtuse; stamens 6 mm long, the filaments slender, glabrous, the anthers purplish; capsules clavate, 3 to 4 mm long, 2 mm broad, glabrous, 4-seeded, the seeds flat, muricate.

Type in the herbarium of the Field Museum of Natural History, no. 981916, collected at Champerico, Department Retalhuleu, Guatemala, in a dry thicket at sea level, February 26, 1939, by Paul C. Standley (no. 66612). An isotype is in the U. S. National Herbarium (no. 1790340).

In general appearance *A. serrata* is similar to *A. longipes*, but is readily distinguished by its serrate bracts and its smaller and more glandular leaves.

Averia longipes (Standl.) Leonard, comb. nov.

Drejerella longipes Standley, Field Mus. Publ. Bot. **8**: 47. 1930.

The type, collected at Chichen Itza, Yucatan, February 27–28, 1899, by C. F. Millspaugh (no. 1621), is at the Field Museum (no. 437703), as also another specimen, collected at Buena Vista by G. F. Gaumer in 1899.

Megalostoma Leonard, gen. nov.

Sect. Louteridieae. Calyx 5-partitus, irregularis, coriaceus, segmentis lateralibus falcatis, anterioribus angustissimis; corolla bilabiata, labiis late apertis, labio superiore angusto, erecto, inferiore cochleariformi; stamina 2; antherae sagittatae. Frutex; paniculae laxae terminales.

Type species, *M. viridescens* Leonard.

The genus *Megalostoma* has apparently no close affinities, although its irregular coriaceous calyx and tubercular pollen grains suggest a possible relationship to *Louteridium* Wats. The name *Megalostoma* alludes to the widely open corollas.

Megalostoma viridescens Leonard, sp. nov.

Frutex, ramis glabris, subquadrangularibus, angulis anguste alatis; lamina foliorum oblongo-elliptica, acuminata, basi angustata, glabra; petioli tenues; paniculae laxae, secundae; calyx glaber, segmento posteriore elliptico, obtuso, lateralibus lanceolatis, subacutis, anterioribus angustissimis; corolla viridescens, glanduloso-pubescens; ovarium glabrum.

Shrub, up to 2.5 meters high; branches subquadrangular, narrowly winged, glabrous, the cystoliths subpunctiform; leaf blades oblong-elliptic, up to 12 cm long and 5 cm wide, slenderly acuminate at apex (the tip often

curved), narrowed at base, glabrous, blackish in dried specimens, the cystoliths obscure; petioles slender, up to 5 mm long; flowers relatively few, secund, borne in loose terminal panicles; bracts leaflike, soon deciduous; calyx segments 1.5 cm long, the posterior segment elliptic, 7 mm wide, obtuse, the lateral pair lanceolate, 5 mm wide, acutish, falcate, the anterior pair narrowly lanceolate, 1.5 mm wide, all glabrous, coriaceous, blackish in dried specimens; corolla greenish white, glandular-pubescent, the lips about 2.5 cm long, entire, the upper lip linear-oblong, about 5 mm wide, obtuse, erect, the lower about 16 mm wide, obtuse, cochleariform; stamens equaling the corolla lips, the anthers 7 mm long, acute at the base, the sacs parallel; pollen grains ellipsoidal, tubercular, with an equatorial row of pores ("Stachelpollen"); style as long as the stamens, reclining in the lower lip of the corolla; ovary glabrous; capsule not seen.

Type in the herbarium of the Field Museum of Natural History, no. 990983, collected at Escoba, across the bay (west) from Puerto Barrios, Department Izabal, Guatemala, in a wet forest near sea level, May 3, 1939, by Paul C. Standley (no. 72948). Nos. 72896 and 73025 of Mr. Standley's collection, with identical locality data, are the same.

Remarkable for its widely divergent corolla lobes, spreading at a right angle, which bear a fanciful resemblance to the yawning mouth of a pelican.

ENTOMOLOGY.—*The oviposition habits of the Eucharidae (Hymenoptera).*[1] CURTIS P. CLAUSEN, U. S. Bureau of Entomology and Plant Quarantine.

The Eucharidae are a family of small wasps that are parasitic upon the mature larvae and the pupae of ants. This limitation in host preferences to a single family or superfamily, whichever status is given to the group, is in sharp contrast to the wide host range of related families of the Chalcidoidea. The family is world-wide in distribution but is encountered most frequently in the Tropics. The adults are black, metallic blue, or green, often with the thorax distinctively sculptured, and many species have the scutellum variously modified, in may species it being produced into a conspicuous bifurcate process that may extend beyond the tip of the abdomen. Not only are they conspicuous and often weird in form, but the habits and relationships of these insects to their hosts are so unusual and varied as to be outstanding, even in an order in which the most diverse adaptations to the parasitic mode of life are found.

The first studies on the biology and habits of the Eucharidae were by Wheeler (1907), who found several species of *Orasema* associated with ants of the genera *Pheidole* and *Solenopsis* in Texas and Colorado. He reared several successive "broods" of *O. viridis* Ashm.[2] upon *Pheidole instabilis* Emery and described and figured the larval instars

[1] Received August 10, 1940.

[2] According to A. B. Gahan, the species here referred to is probably *Orasema wheeleri* Wheeler and not the true *viridis* Ashm. (See Proc. U. S. Nat. Mus. **88**: 459. 1940.)

and the pupa. Oviposition was not observed nor were the eggs found, yet so certain was he that these must be placed directly upon the ant pupae that he described in some detail the manner in which the female was presumed to accomplish this act. The conclusions reached were entirely logical on the basis of what was then known regarding the habits of parasitic insects.

A few years later H. S. Smith (1912) presented a detailed account of the biology of *Perilampus hyalinus* Say, of the family Perilampidae, which is closely allied taxonomically to the Eucharidae. Here again the act of oviposition and the egg were not seen, but the first instar larva proved to be identical in general characters with that of *Orasema*. These planidia (*dimunitive wanderers*) differed from other known parasitic hymenopterous larvae in the possession of a fusiform body and a highly sclerotized and darkened integument. Because of the form and habits of the planidium of *Perilampus*, Smith was convinced that oviposition did not take place directly in or on the host, and he believed that the eggs were more probably deposited upon the food plant in the vicinity of a colony of hosts. In discussing Wheeler's observations on *Orasema* he pointed out the similarity in form and habits of the larvae with those of *Perilampus* and suggested the probability that oviposition takes place entirely outside the ant nest. Smith was able later (1917) to verify the leaf-ovipositing habit in *P. chrysopae* Cwfd., and this discovery served to stimulate interest in the habits of the two families.

The first discovery of the oviposition habits of a species of Eucharidae was purely accidental. During the course of a study of the insect fauna of wild cotton in Arizona, Pierce and Morrill (1914) chanced to observe two females of *Chalcura arizonensis* Cwfd. with their ovipositors inserted in apparently healthy blossom squares of this plant. Upon later examination these squares were found to contain masses of minute eggs immediately beneath the points of insertion of the ovipositors. This record was entirely overlooked by later workers, and it was not until the writer's account of the habits of (*Schizaspidia*) *Stilbula tenuicornis* (Ashm.), published in 1923, that the plant-oviposition habit became generally known. Since that time observations have been made upon the oviposition habits of 7 additional genera and 12 species occurring in various parts of the world,[3] and several other in-

[3] The writer is indebted to A. B. Gahan, of the U. S. Bureau of Entomology and Plant Quarantine, for the determination of species and for the descriptions of those that have proved to be new (Proc. U. S. Nat. Mus. **88**: 425–458. 1940). In a forthcoming publication (*Entomophagous insects*, New York) a short account is given of the biology and habits of the family. At the time of submission of the manuscript the names of

vestigators have added to our knowledge of this subject, so that it is now possible to present an account of several of the principal oviposition habits of the family. In every instance it has been found that the eggs are deposited entirely apart from the host, that the association with plants for this purpose is obligatory, and that a wide range exists with respect to the manner of deposition of the eggs and the part of the plant on or in which they are placed.

As an aid to others who may be interested in studying the habits of the family, it may be mentioned that the oviposition habits can be readily and quickly determined by observations on females in the field. They oviposit almost immediately after leaving the ant nest and, because of their limited and relatively slow flight, can be followed until they alight upon the plant that is to receive their eggs. The elapsed time from emergence to oviposition is usually less than 1 hour. Botanical gardens provide exceptional opportunites for the study of the Eucharidae, as the variety of plants grown there insures that some will be present that are suitable for oviposition by such species as may occur in that locality. Also, the ant population is usually relatively high and of many species. The Botanical Garden at Peradeniya, Ceylon, was especially fruitful and yielded three species in abundance during a short visit there in February 1930.

OVIPOSITION PLANTS

In Table 1 are given the species of which the habits are known and the plant or plants with which each one is associated for oviposition. The records are based on the author's observations unless otherwise indicated.

PART OF PLANT UTILIZED FOR OVIPOSITION

The part of the plant utilized for oviposition varies with the species and may be the overwintering buds, opening flower buds, stems of blossom clusters, seed pods, or leaves. The variations in habit, in relation to the part of the plant that serves to receive the eggs, are here discussed under the following headings:

1. In overwintering buds. The single species that is definitely known to pass the winter in the egg stage is *Stilbula tenuicornis* of Japan and Chosen, which places its eggs in the overwintering buds of mulberry (Fig. 1) and, to a lesser extent, in those of chestnut, oak, birch, and

Gahan's new species were not available, and several were referred to under the generic name only. These are now assigned as follows: *Psilogaster* sp. from Malaya = *P. antennatus* Gahan; *Parapsilogaster* sp. from Ceylon = *P. laeviceps* Gahan; *Eucharis* sp. from Chosen = *E. scutellaris* Gahan; and *Schizaspidia* sp. from Malaya = *S. antennata* Gahan.

TABLE 1.—OVIPOSITION PLANTS OF THE EUCHARIDAE

Species	Plant	State or Country	Authority
Chalcura arizonensis Cwfd.	*Thurberia thespesioides.*	Arizona	Pierce & Morrill, 1914.
Chalcura deprivata (Walk.)	*Artocarpus integrifolia, Codiaeum, Cordia myxa.*	Ceylon	
Eucharis scutellaris Gahan	*Cebatha orbiculata.*	Do.	
Kapala foveatella Gir.	*Gliricidia sepium,*	Philippine Islands	Ishii, 1932.
	Leucaena glauca.	Java	
Kapala furcata (F.)	*Mikania micrantha,* a species of the Amaranthaceae.	Panama	
Kapala terminalis Ashm.	*Tragia volubilis, Casearia spinescens.*	Cuba	
Kapala sp.	*Tragia volubilis.*	Do.	
Losbanos uichancoi Ishii	*Celtis philippinensis, Leucaena glauca.*	Philippine Islands	Ishii, 1932.
Orasema aenea Gahan	*Ilex paraguayensis.*	Argentina	A.A. Ogloblin (Gahan, 1940).
Orasema coloradensis Wheeler	*Stylosanthes biflora, Ceanothus americanus.*	Virginia	
Orasema smithi How.	*Casearia spinescens.*	Cuba	
Parapsilogaster laeviceps Gahan	*Artocarpus integrifolia.*	Ceylon	
Parapsilogaster montanus Gir.	*Sandricum koetjape, Premna* sp.	Philippine Islands	Ishii, 1932.
Psilogaster antennatus Gahan	*Mangifera indica, Erythrina* sp.	Federated Malay States	
Schizaspidia antennata Gahan	*Eugenia, Medinella.*	Do.	
Schizaspidia convergens (Walk.)	*Artocarpus integrifolia.*	Ceylon	
Stilbula cyniformis Rossi	*Picris hieracioides* var. *spinulosa.*	France	Parker, 1937.
Stilbula manipurensis (Clausen)	*Flamingia latifolia.*	India	
Stilbula tenuicornis (Ashm.)	*Castanea sativa,*	Japan	
	Betula sp.,	Do.	
	Morus alba.	Do.	
	Cladrastis amurensis var. *floribunda.*	Do.	
	Quercus mongolica.	Chosen	

Cladrastis amurensis var. *floribunda* (Clausen, 1923). The entire quota of eggs of the female, numbering approximately 1,000, is deposited within the interior of the bud at one insertion of the ovipositor.

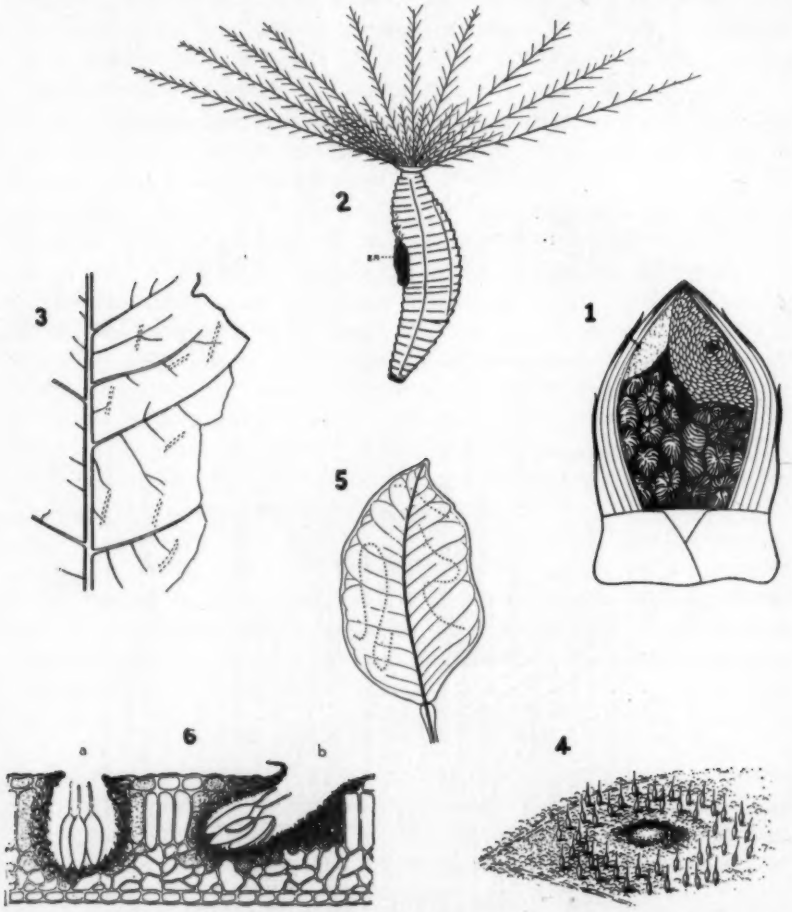

Fig. 1.—A mulberry flower bud cut away to show two egg masses of *Stilbula tenuicornis* (Ashm.). Fig. 2.—A seed, with fully expanded plumes, of *Picris hieracioides* var. *spinulosa* bearing a mass of eggs (*E.M.*) of *Stilbula cyniformis* Rossi (from Parker, 1937). Fig. 3.—A portion of a leaf showing, on its under side, the paired rows of oviposition scars of *Losbanos uichancoi* Ishii (from Ishii, 1932). Fig. 4.—A group of eggs of *Psilogaster antennatus* Gahan upon the leaf surface surrounding a freshly deposited egg of *Selenothrips rubrocinctus*. Fig. 5.—A fleshy leaf showing the serpentine lines of oviposition scars of *Schizaspidia antennata* Gahan. Fig. 6.—A diagrammatic section through a fleshy leaf showing (*a*) a group of three eggs of *Parapsilogaster laeviceps* Gahan and (*b*) a group of four eggs of *Schizaspidia antennata* Gahan in their characteristic position resulting from the insertion of the curved ovipositor at a sharp angle to the leaf surface.

These eggs remain therein until the following spring, when the buds expand and the great majority of egg masses fall to the ground with the bud scales. A portion of the buds die, however, and the scales draw apart somewhat, thus permitting the escape of the larvae, which hatch from the eggs during July and early in August.

2. In expanding leaf and flower buds. A number of species, representing several genera, utilize the expanding leaf and flower buds of various plants for oviposition. *Eucharis scutellaris* of Chosen, which oviposits in those of a trailing vine of the genus *Cebatha,* may even deposit her eggs in fully opened blossoms. Less than 50 eggs are placed in the center of each one, and consequently each female visits a considerable number of blossoms before oviposition is complete. *Kapala furcata* oviposits similarly in the flower buds of another vine, of the genus *Mikania,* and of an undetermined species of Amaranthaceae. A colony of this parasite was found inhabiting the small plot of open ground immediately in front of the main laboratory building on Barro Colorado Island, Panama Canal Zone.

Chalcura arizonensis deposits its eggs in the blossoms of wild cotton in Arizona, while *C. deprivata* of Ceylon does so in the leaf buds of jak fruit, though some individuals were seen to utilize the expanding flower buds of croton and *Cordia. Stilbula manipurensis* of Assam places its eggs in masses beneath one of the outer scales of the large, loosely formed buds of *Flamingia* (Clausen, 1928). *Schizaspidia convergens* deposits them in clusters of a few hundred beneath the outer scales of leaf buds, and occasionally in the flower buds also, of jak fruit in Ceylon, and usually high up in the tree. Buds containing egg masses can frequently be recognized by the presence of a curled ribbon or thread of white congealed sap, several millimeters in length, at the point penetrated by the ovipositor. In all these species the incubation period is relatively short, covering not more than two weeks, but before hatching takes place the bud scales and petals fall to the ground and carry the great majority of eggs with them.

3. In seed receptacles. Parker (1937) describes the oviposition of *Stilbula cyniformis* in the seed heads of a small composite plant of the genus *Picris* in southern France. The eggs are deposited en masse among the bracts or adhering to the outer layer of seeds. As the seed head opens the plumes of each seed expand and the seed, with its burden of eggs (Fig. 2), is blown away. Inasmuch as oviposition takes place only during August, it is possible that this species, like *S. tenuicornis,* passes the winter in the egg stage. After completion of oviposition the female often dies with her ovipositor still inserted in the seed receptacle.

4. In incisions in leaf tissue. The females of *Schizaspidia antennata*, the commonest of the eucharid species observed at Kuala Lumpur, Federated Malay States, usually deposit their eggs in pairs, but at times in groups of three or four, in incisions in the under sides of the fleshy leaves of *Eugenia, Medinella*, etc. These punctures are evenly spaced about 1 millimeter apart and are made in serpentine rows over the leaf (Figs. 5, 6, *b*). When the trees are in bloom oviposition is frequently in the fleshy stems of the blossom clusters rather than in the leaves. *Parapsilogaster laeviceps* shows a pronounced preference for the half-grown leaves of jak fruit, the eggs are laid singly in incisions on the under side, usually near the leaf margin, and the incisions are made somewhat at random rather than in rows.

In July 1932 J. C. Bridwell showed the writer a colony of *Orasema coloradensis* at Barcroft, Va., that was restricted to a very limited area along a railroad right-of-way and bordering a wooded area. The females were seen to be ovipositing in the younger leaves of the small-leaf pencil-flower, *Stylosanthes biflora*, and also occasionally beneath the bud scales of the large-leaf Jersey tea, *Ceanothus americanus* (determinations by Dr. S. F. Blake). In the pencil-flower the eggs are placed singly or in pairs in incisions in the under sides of the younger leaves. between the parallel veins. While there may be several punctures in a row, yet because of the small size of the leaf any distinct linear or serpentine arrangement of the punctures is prevented. An elongate area of leaf-tissue about the puncture becomes discolored and dies. In the limited area inhabited by this colony practically every leaf of the pencil-flower contained one or more eggs, and the numerous areas of dead tissue gave the plants the appearance of being diseased. *O. smithi* oviposits in the same way, but this species is distinctive in that it oviposits only in the upper sides of the leaves and limits itself to those within 2 feet of the ground. *Kapala terminalis* likewise oviposits in the upper rather than the lower sides of the leaves.

Ishii (1932) describes the somewhat similar leaf-ovipositing habits of two species from the Philippine Islands. The females of *Kapala foveatella* place one to four eggs in each incision in the lower sides of the leaves of *Gliricidia and Leucaena*. The oviposition punctures made by *Losbanos uichancoi* on the under sides of the leaves of *Celtis* and *Leucaena* occur in two short parallel rows, each row comprising five to ten punctures. This oviposition in a double rather than in a single row, as is the habit of other species, is an interesting variation, but unfortunately the author does not describe the manner in which it is accomplished. His illustration (Fig. 3) indicates that the two rows of eggs are

deposited simultaneously, the ovipositor apparently being inserted alternately right and left as the female moves forward.

5. At random on leaf surface. This oviposition habit was first observed by Ishii in the case of *Parapsilogaster montanus* at Los Banos, Philippine Islands. The eggs are deposited horizontally on the under sides of the leaves of *Sandricum* and *Premna*, and, when abundant, they give a white, powdery appearance to the leaf surface. A species of *Kapala* found in Cuba, and not distinguishable in the adult stage from *K. terminalis*, oviposits in the same way upon the leaves of *Tragia volubilis*. A female normally deposits her entire quota of eggs upon a single leaf, and each of these may bear many thousands of eggs. She walks about very slowly over the leaf, tapping its surface rapidly with the tip of the ovipositor, and one or two eggs are extruded each time. Leaves bearing fully incubated eggs appear as if covered with a fungous growth, the slender egg stalks resembling hyphae and the deep amber-colored egg bodies the conidia. These species, and *Psilogaster antennatus*, are among the very few Chalcidoidea that deposit eggs of the stalked type in such a position that they are completely exposed.

6. Upon leaf surface associated with thrips eggs. One of the most striking and highly specialized adaptations in oviposition in the Eucharidae was observed in the Malayan *Psilogaster antennatus*, which was collected in some numbers in January 1930 near Kuala Lampur. The eggs are placed vertically, regularly spaced and in numbers up to 100, in the immediate vicinity of a freshly deposited thrips egg (Fig. 4). Under cage conditions oviposition could not be secured in the absence of these eggs, and the relationship appears to be obligatory. The thrips species concerned, *Selenothrips rubrocinctus* (Giard), was found commonly only on mango and *Erythrina* foliage. The thrips female partially inserts the egg in an incision in the under side of the leaf and covers it with a mass of excrement. The female parasite is attracted to the egg itself rather than to excrementous covering. The parasite's association with the foliage of the two trees mentioned is believed to be incidental and it very probably will be found to frequent any type of plant which bears an infestation of *Selenothrips*. The presumed ant host of *Psilogaster* is not known, so it is impossible to give any convincing explanation of this association with thrips. Several species of the genus have been reared from *Myrmecia* and *Pheidole*, so there is little basis for believing in any radical departure in host preferences. The association with thrips undoubtedly relates to phoresy, as the eggs hatch simultaneously with those of the carrier and the planidia attach themselves to the young thrips larva as soon

as it emerges from the egg and are carried about until the first molt of the latter. Were the thrips attended by ants, or carried into their nests, the relationship would serve a definite and obvious purpose, but such is not the case.

The number of species for which information is available regarding their oviposition habits is still too small to warrant any generalizations, and in all probability other and perhaps radical departures from those discussed will be found. In examining the data given in the preceding paragraphs it is seen that there is little uniformity in habit even among species of a genus. *Parapsilogaster laeviceps* places its eggs in incisions in leaf tissue, whereas *P. montanus* deposits them at random on the leaf surface. *Kapala fovealella* and *K. terminalis* oviposit in leaf tissue, *K. furcata* in the expanding blossom buds of a vine, and an undetermined species of *Kapala* places its eggs loosely upon the leaf surface. *Stilbula tenuicornis* oviposits in overwintering leaf and flower buds, *S. manipurensis* in expanding flower buds, and *S. cyniformis* in seed receptacles. The three species of *Orasema* are, however, consistent in placing their eggs in incisions in leaves.

MANNER OF OVIPOSITION

The species of *Stilbula*, *Kapala*, *Eucharis*, *Chalcura*, and *Schizaspidia* that deposit their eggs in buds or seed receptacles have a uniform manner of oviposition. The female penetrates the scales or covering by a downward thrust of the ovipositor, and full penetration of a bud with heavy scales may require 5 minutes or more. In no instance has a female been seen to insert the ovipositor between the scales.

Two distinct methods of oviposition are found among the species that oviposit in leaf tissue. *Parapsilogaster laeviceps* (Fig. 6, *a*) and *Orasema coloradensis* merely puncture the leaf tissue by a perpendicular thrust of the straight ovipositor, and consequently the perforation in the epidermis is found at the center of an area of dead tissue, which, within a few days, becomes about 1 millimeter in diameter. *Schizaspidia antennata*, however, has a much heavier ovipositor, which is distinctly curved downward, so that when it is lowered preparatory to oviposition the tip is directed forward. Insertion into the leaf is consequently effected by a forward pull rather than by a backward or downward thrust. After being inserted to the proper depth in the fleshy leaf tissue, it is swung from side to side through an arc of about 45°, with the base held stationary. This results in the formation of a fan-shaped recess within the leaf, in which two to four eggs are placed (Fig. 6, *b*). On leaves in which eggs have been deposited several days

previously the area of dead tissue is almost entirely posterior to the surface incision.

It has been mentioned that *Schizaspidia antennata* oviposits also in the heavy fleshy stems of the flower clusters of certain trees. At these times it often happens that the eggs are deposited externally rather than embedded in the stems. The tissues of the stem are very soft and tender and offer very little resistance to the ovipositor. It is inserted transversely to the axis of the stem but, because of its curvature, the tip breaks through the surface farther on, thus making a double perforation of the epidermis such as is done with a curved surgeon's needle. The eggs are then extruded from the ovipositor and only the slender anterior stalks remain embedded in the puncture.

Orasema smithi inserts the ovipositor in the same way as *Schizaspidia antennata*, and its incisions are readily recognized by the triangular form of the surface puncture. The single egg deposited at each insertion is found at the anterior end of the cavity rather than at the center.

The female of *Psilogaster antennatus* makes a very minute puncture in the epidermis of the mango leaf and embeds the pointed posterior tip of the egg therein so that it is firmly held in an erect position, with the anterior stalk turgid and straight.

The form of the incision and the cavity produced in the plant tissue are thus seen to differ among species and they permit of provisional recognition in the field. An examination of the ovipositors of the females often gives a clue to the manner and place of oviposition. A heavy curved ovipositor points to oviposition in succulent leaves and stems whereas one which is long, straight, and slender indicates that the eggs are probably placed in buds or seed pods.

SUITABILITY OF DIFFERENT PLANTS FOR OVIPOSITION

The suitability or otherwise of a plant for oviposition by Eucharidae appears to be governed mainly by the physical qualities of the part in which the eggs are placed, rather than by definite attraction. *Stilbula tenuicornis*, a bud-ovipositing species, favors mulberry in northern Japan, but it also oviposits to a lesser extent in chestnut, birch, and *Cladrastis*, while in Chosen it was seen to do so in the buds of oak. These buds have certain qualities in common. The scales, while firm, are not too hard for penetration by the ovipositor, the interior of the bud has at least a small amount of free space in which the eggs may be placed, and the sap is nonresinous. The adults of this species are present in the field for only about three weeks each year, and they

consequently are limited in oviposition to such trees as have their buds fully formed at that time. The same requirements are encountered among other species, such as *S. cyniformis*, which oviposit in seed receptacles.

Among the leaf-ovipositing species, those that insert the eggs in incisions in the tissue restrict themselves to plants having leaves with certain physical qualities. When one surface is punctured the wound must remain permanently open to permit of the later escape of the larvae. This rules out the plants that exude appreciable amounts of sap from leaf wounds. Plants with rather fleshy and smooth leaves, such as *Artocarpus*, *Citrus*, and *Codiaeum*, are most frequently chosen. The two leaf-ovipositing species observed in Ceylon, representing the genera *Parapsilogaster* and *Chalcura*, both deposit the great bulk of their eggs in *Artocarpus*. *Orasema smithi* and *Kapala terminalis*, which were found in the same habitat at Hoyo Colorado, Cuba, both oviposit in the leaves of *Casearia*. *O. coloradensis*, however, chooses the small and very delicate leaves of *Stylosanthes*. The collection notes of C. F. Baker, given by Gahan in his discussion of *O. wheeleri* Wheeler, show three collections on separate dates on *Eriogonum* at Fort Collins, Colorado. It is quite possible that the females were ovipositing in the leaves of that plant.

In the temperate regions, where the various species apparently have only a single generation each year and the adults are present for only a very short period, the number of plant species that serve for oviposition is at a minimum and a single one may suffice. That chosen in one locality may differ from the one favored in another. Some of the tropical Eucharidae, most of which are assumed to have overlapping generations throughout the year, may change their oviposition plants with the seasons. This is of most probable occurrence among those that oviposit in buds, particularly flower buds, and seed receptacles.

The above generalization regarding the factors influencing the choice of plants for oviposition apparently does not hold true with species that deposit their eggs in expanding flower buds, and some, at least, exhibit a strong response to what is apparently an odor stimulus. The most striking example of such a reaction was observed in *Eucharis scutellaris*, which places its eggs in the flower buds of *Cebatha orbiculata*. A sprig of this vine held near an ant nest from which *Eucharis* is emerging will attract all females in the vicinity within a few minutes. If shaken off they immediately return to the buds and cling to them tenaciously. The males, however, are not attracted to these buds.

Only two species are known to deposit their eggs at random on the leaf surface, but in these instances the plants favored for oviposition have leaves with a hairless and glossy under surface.

RATE OF OVIPOSITION

The total egg capacity of the females of the Eucharidae ranges from a minimum of about 1,000 to a maximum of 10,000 or more. The eggs are very minute, seldom exceeding 0.2 mm in length even in the larger species, and those of the smaller species may not exceed 0.1 mm. The smaller total given above is for *Stilbula tenuicornis*, which deposits the entire lot en masse in a bud during an elapsed time averaging 20 minutes. This is at the rate of one egg a second, and consequently they must flow from the ovipositor in virtually an unbroken stream during this period. Where the parasite population is high, as in one locality near Koiwai, Japan, several of these masses are deposited in each bud, and one rather sparse mulberry bush 7 feet in height was estimated to contain 4,320,000 eggs. One bud was found to contain 24 egg masses. Because of the limited space available in the bud a high pressure must be exerted by the later females in forcing their eggs into the bud, and instances were seen where previously deposited eggs had been forced out through the older ovipositor puncture holes in the bud scales. The most striking illustration of such pressure was observed in *S. manipurensis*. One *Flamingia* bud showed a "ribbon" of eggs 2.5 mm in length and 1.0 mm in width that had been forced out from beneath the margin of a bud scale at a distance of 2 mm from the point of insertion of the ovipositor.

An undetermined species of *Kapala* from Cuba, which deposits its eggs at random on the leaf surface, has an exceedingly high egg capacity. One female deposited a total of approximately 10,000 eggs during a period of six hours. While the rapidity of deposition does not equal that of *Stilbula*, yet the total is much greater. Parker (1937) mentions the possibility of the production of 10,000 to 15,000 eggs by each female of *Stilbula cyniformis*.

In general it is the habit of the species that deposit their eggs en masse to complete oviposition the day of emergence from the host nest, and this appears to be true also of those that place them at random on the surface of leaves. Those that insert them singly or in small groups in leaf tissue are more deliberate in their oviposition activities and this may extend over one week or more. The number of eggs deposited each day is consequently only a few hundred, though a female of *Schizaspidia antennata* was seen to make 10 to 12 insertions of the

ovipositor a minute, which represents a deposition of about 30 eggs during that period. In other species, however, the interval between insertions is much longer.

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ENTOMOLOGY.—*A genus of histerid beetles new to the United States.*[1] RUPERT L. WENZEL, Field Museum of Natural History. (Communicated by EDWARD A. CHAPIN.)

During the summer of 1938, I had occasion to visit the U. S. National Museum and to examine briefly the Histeridae of that institution's collection. A specimen collected in Texas and determined by Herbert S. Barber as *Reninus salvini* Lewis was called to my attention. Reference to the original description of that species revealed a discrepancy between the specimen and the description; however, on the basis of notes made by Dr. Gilbert J. Arrow, of the British Museum, who kindly examined the type, there can be no doubt that the Texas example is to be referred to that name. Since the genus *Reninus* has not heretofore been known from America north of Mexico, a generic and species description are given here. Acknowledgment is due Dr. Edward A. Chapin and H. S. Barber for their kind cooperation in making the specimen available for study.

Genus **Reninus** (s. str.) Lewis

Reninus Lewis, 1889, p. 275.
Renia Lewis, 1885, p. 467.

Form oblong-oval, moderately convex. Head with a marginal carina on each side of the epistoma, the carina continuous with the supraorbital stria. Labrum transverse, its anterior margin straight or with a slight production inferiorly. Antennae with nine articles, the club consisting of a "single" article, which is strongly sclerotized at base and densely pubescent at apex;

[1] Received July 25, 1940.

flagellum articulated laterally to the antennal scape, which is angulately swollen distally. Pronotum transverse, anterior angles obliquely truncated; marginal pronotal stria present, lateral pronotal striae absent. Elytral striae carinate. Propygidium transverse, hexagonal, nearly twice as broad as long. Pygidium subcircular, nearly vertical. Prosternal keel striate, basal margin deeply, angulately incised; prosternal lobe broad. Antennal cavities deep, visible from beneath. Mesosternum very short, consisting of little more than a strongly angulate process, which fits into the incised prosternal base. Tibiae rather strongly expanded; all the tarsal grooves distinct, straight, only their inner margins well defined. Outer margin of anterior tibiae broadly, evenly arcuate, multidenticulate, the denticles fine, short, spinelike. Outer margin of middle and posterior tibiae more or less angulate, denticulate as in the anterior tibiae. All the tarsi of five articles, ultimate article bearing two claws.

Genotype.—*Reninus meticulosus* Lewis, 1885, p. 467.

According to Reichensperger (1935, p. 26), the genus *Brachylister* Bickhardt (1917, p. 234) should be placed under *Reninus* and is not to be accorded any higher ranking than that of a subgenus. The arguments in favor of this arrangement are well founded, and it will probably be most satisfactory to follow it.

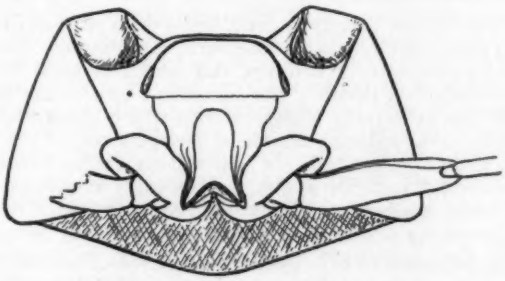

Fig. 1.—*Reninus salvini* Lewis: View showing gross structure of under side of prothorax.

My diagnosis of *Reninus* would undoubtedly be of more value if it were based on all the species known; however, since many of the forms are unavailable, the description is based on characters known to me, and it will serve to separate *R. salvini* from the species of other North American histerid genera.

Reninus belongs to the tribe Hetaeriomorphini of the subfamily Hetaerinae and may be separated from the other North American genera of the tribe as follows:

1. Elytra with dorsal striae.....2
   Elytra rather densely punctate, without dorsal striae.....4
2. Anterior margin of mesosternum deeply emarginate to receive the prosternal base; anterior tibiae subcircular; a lateral pronotal stria present .....*Yarmister* Wenzel (1939, p. 391)
   Anterior margin of mesosternum produced (feebly in *Ulkeus*), the mesosternal process received in the emarginate prosternal base; anterior tibiae not subcircular, though they may be strongly expanded; pronotum without a lateral stria in addition to the marginal stria.....3

3. Pronotum without a lateral gibbous area; anterior margin of mesosternum strongly, angulately produced, the process received in the strongly emarginate prosternal base; elytra without rows of trichomes along the striae..... *Reninus* Lewis

   Pronotum with a longitudinal gibbous area on each side; anterior margin of mesosternum feebly, obtusely produced (nearly truncate); elytra with rows of trichomes along the striae... *Ulkeus* Horn (1885, p. 143)

4. Elytra without dorsal striae, rather densely punctate; pronotum gibbous at the sides, the gibbous area divided into distinct cushionlike lobes; anterior margin of mesosternum produced and received in the angulately emarginate prosternal base..... *Terapus* Marseul (1862, p. 680)

The tribe Hetaeriini (composed in North America of the genera *Echinodes* and *Hetaerius*) may be separated from the Hetaeriomorphini by the condition of the antennal club, which is oval in the latter tribe; in the Hetaeriini the club is cylindrical and truncated at the tip, the truncated tip being densely pubescent.

Reninus salvini (Lewis) Fig. 1

Renia salvini Lewis, 1888, p. 220, pl. 8, figs. 6, 7.
Reninus salvini Lewis, 1905, p. 52.

Form oblong-oval, moderately convex. Color deep reddish brown, shining. Head, labrum, and mandibles with fine, sparse, setigerous punctures, those of the mandibles aciculate. Mandibles and vertex of head with a few fine rugae. Supraorbital stria distinct but somewhat broken up, continuous on each side with the cariniform marginal stria which commences within the eyes and extends to the anterior margin of the epistoma.

Pronotum a little less than twice as wide as long, rather strongly impressed on each side near the anterior angles, less strongly impressed on each side near base, sharply, sparsely punctulate throughout; sides nearly straight, moderately converging to the truncated anterior angles. Marginal pronotal stria extremely fine, cariniform, complete laterally, interrupted behind the head.

Elytra sharply, sparsely punctulate throughout. Epipleura finely strigose, with two fine cariniform striae, of which the outer is short and apical, the inner (marginal elytral stria) is very close to the epipleural margin basally but extends dorsally to transverse the epipleural fossette on apical two-thirds, and from thence extends half way across the elytral apical margin. External subhumeral stria complete, cariniform, strongly sinuous, and "fused" with the internal subhumeral stria for a short distance near the middle; internal subhumeral stria complete, nearly straight, costiform basally, finely cariniform and close to the first dorsal stria near apex, forming the margin between the elytral disc and the epipleuron. First dorsal stria complete, cariniform basally, costiform apically; second dorsal stria finely cariniform, very slightly abbreviated at apex; third and fourth dorsal striae finely cariniform, extending to about apical third, the fourth stria arching broadly at base and recurving briefly along the suture; sutural stria absent; internal subhumeral stria and the dorsal striae strongly, inwardly, transversely hooked at base. Propygidium and pygidium sparsely punctulate.

Prosternum moderately broad, the keel completely margined, the carinal striae finely cariniform, joined in an arch anteriorly and continuous at base along the incised margin; lateral prosternal striae cariniform, divergent and ascending, extending to the prosternal lobe; on each side between the carinal

and lateral striae are two fine abbreviated striae; prosternum (except the enclosed keel) and prosternal lobe microscopically, densely strigose and sparsely, finely punctate, the punctures elongate, linear. Prosternal lobe with the anterior margin truncate, margined, the marginal stria deep and terminating on each side in deep, elongate foveae.

Mesosternum very short, strongly, angulately produced at middle; meso-metasternal stria slightly anterior to the meso-metasternal suture, and trisinuate, the middle sinuation strongest. Metasternum sparsely, remotely punctulate, with four apically diverging striae on each side, these striae joined medial to the middle coxal cavity; the innermost stria is straight and extends posteriorly one-half the length of the metasternum; the next stria is complete and extends to the anterior margin of the posterior coxal cavity; the two outer stria are arcuate and extend laterally on the elevated metasternal sides. Meso- and metathoracic pleurites with a number of strioliform punctures. Anterior margin of first abdominal sternite with a complete transverse, crenate, marginal stria; within the coxae on each side are three cariniform, longitudinal striae of varying length.

Length: 3.5–4.2 mm. Width: 2.7 mm.

Remarks.—The specimen upon which this description is based was collected by E. V. Walters in a nest of *Atta texana* (Buckley) at a depth of between 6 and 10 feet at San Antonio, Tex., January 17, 1935.

Lewis's type of this species was collected in an ant nest beneath a stone at Atlisca, Puebla, Mexico, but the host was not recorded. Later (1907, p. 105) Lewis recorded *Atta cephalotes* as a host species, and Bickhardt (1917, p. 241) gives *Atta fervens* Say (*sic*). Other *Reninus* are known to be attaphiles, and one species (*R. meticulosus* Lewis) has been recorded from *Atta* nests (*A. sexdens*, fide Reichensperger, loc. cit.) and from termite galleries (Lewis). The attaphilous Histeridae, believed to be chiefly synechthrans, are few in number, the only other species apparently known from the United States being *Acritus attaphilus* Wenzel (loc. cit., p. 384).

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ZOOLOGY.—Austrobdella anoculata, *a new species of fish leech from Greenland.*[1] J. PERCY MOORE, University of Pennsylvania. (Communicated by WALDO L. SCHMITT.)

In the course of his many expeditions to the Arctic, Capt. Robert A. Bartlett has brought back extensive collections of animal and plant life from that region. Among the material collected on opposite sides of Greenland, seven years apart, he obtained two contracted examples of a small marine leech, of which the host is unknown, one from northwest Greenland between Capes Alexander and Chalon, and the other from northeast Greenland.

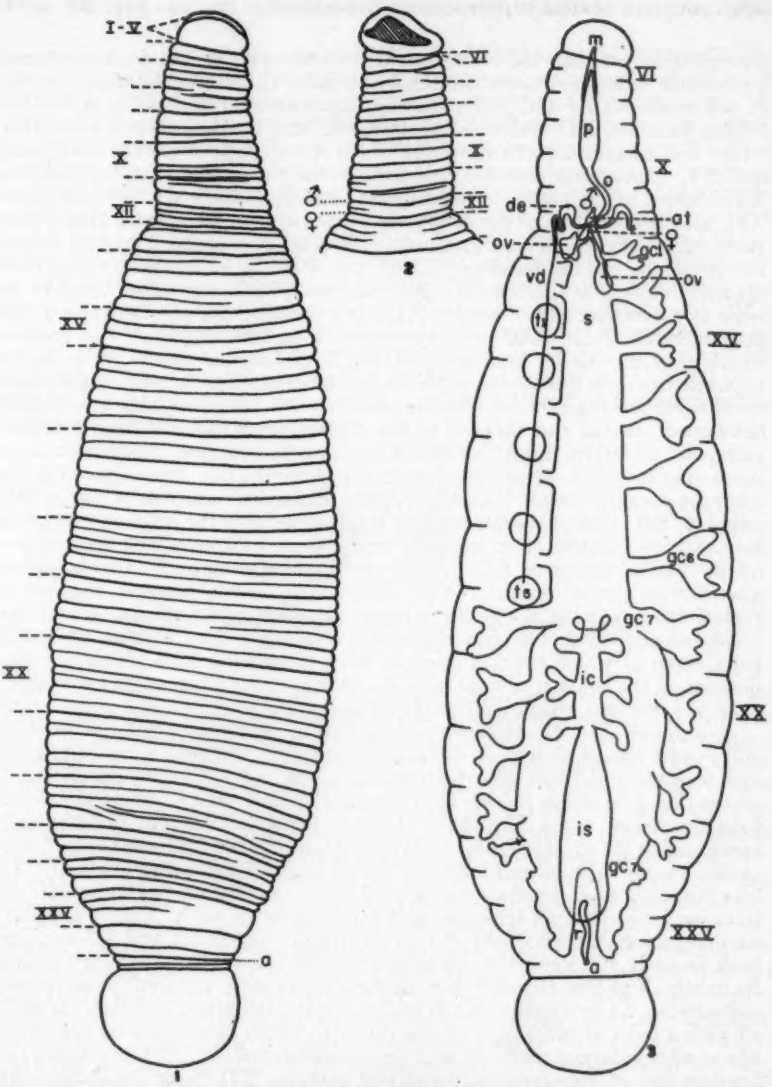
I have been unable to harmonize them with the description of any species hitherto reported from our northern seas. Except for minor differences, they agree with the type of Badham's genus *Austrobdella.* Of the two, the paratype is somewhat less contracted and distorted and for that reason was sectioned for study of the internal anatomy. The drawings and description are based upon both specimens.

Austrobdella anoculata, new species Figs. 1–4

Diagnosis.—Similar to *A. translucens* Badham,[2] but distinguished by absence of eyes, abdomen less abruptly shouldered in adult, somites typically tri- (sex-) annulate; gonopores separated by two annuli, ovisacs short, without prolonged posterior lobes; last pair of gastric caeca with about one-fifth of their caudal ends disunited.

Description.—Body divided into two regions, "neck" and "abdomen," the former short and subcylindrical, the latter about three times as long, abruptly wider and moderately depressed. Measurements in millimeters of type: Length 4.6, to ♂ pore 1.0; widths, cephalic sucker (contracted) about 0.4, at ♂ pore 0.65, maximum (XIX–XX) 1.8, anus 0.7; caudal sucker 0.9; depths not measured but in neck slightly less than widths, in abdomen about three-fourths widths. Paratype at same points 6.8, 1, 4.7, 0.8, 2.1, 0.75, 1.0; maximum depth about 1.4. Cephalic sucker small, about one-half diameter of caudal sucker, normally cup-shaped, but so contracted in both specimens that ventrally it appears as a thickened annular rim surrounding a deep central depression; in dorsal aspect hemispherical, not definitely wider than the first nuchal somites, without obvious markings, only a few very faint traces of annuli on caudal part and a few scattered, very minute, sensory papillae. Eyes absent, in sections a few pigment granules near middle of head, but no pigment cups or visual cells. Mouth seen only in sections as a minute pore on the cephalic slope of a slight papilla at the center of the ventral face of the sucker. Neck sharply differentiated from abdomen (most so in paratype), subcylindrical, slightly depressed, short, about one-sixth or one-seventh length of abdomen, its maximum width about one-seventh that of the widest part of the abdomen, increasing slightly in width cephalocaudad but again slightly contracted at the clitellum; preclitellar annuli about 13, but irregular, some of them double; intermetameric furrows, including the nuchal groove,

[1] Received August 6, 1940.
[2] Quart. Journ. Micr. Sci. (new ser.) **62**: 1. 1916.



Figs. 1–3.—*Austrobdella anoculata*. × ca. 28.

1. Annulation in dorsal aspect as worked out from a comparison of the two specimens. In most respects they agree. Where they differ the one appearing most normal or clearest is usually represented, or in other cases the paratype is represented on the left, the type on the right side. Somites are numbered in Roman on left side. *a*, Anus.
2. Ventral aspect of first 13 segments showing the position of the gonopores.
3. Semidiagrammatic representation of the chief features of the digestive and reproductive organs. The gastric caeca are shown complete on the right side, the male organs on the left side only. *a*, Anus; *at*, atrium; *de*, ductus ejaculatorius; *gc 1–7*, gastric caeca; *ic*, caecate intestine; *is*, saccate intestine; *m*, mouth; *o*, esophagus; *p*, pharynx; *r*, rectum; *s*, stomach or crop; *t 1–5*, testes of left side; *vd*, vas deferens; ♂, male gonopore; ♀, female gonopore.

generally deeper than the interannular furrows and the only visible external metameric character; most somites 3-annulate. Clitellum ill-defined, somite X not modified, XI and XII somewhat narrower, about as wide as the first nuchal annulus, XII embraced at its caudal end by the anterior fold of the wider first abdominal annulus, into which it is slightly recessed; somites XI and XII triannulate dorsally, biannulate ventrally, the second annulus of XI enlarged in the medial ventral field to encroach upon the first annulus of XII, and bearing the ♂ gonopore; on venter all clitellar annuli longer than those of the preceding somites; gonopores (Fig. 2) separated by two annuli, the ♂ on the caudal margin of XI *a3*, the ♀ at XII a2/*a3*, both small and obscure, especially the female, which on the type is concealed beneath the edge of projecting rim of somite XIII but on the paratype is exposed. Abdomen much wider than neck throughout, outline elliptical, the greatest width near middle at somites XVIII–XX (relatively much wider in the type) moderately depressed; cephalic end truncate but not expanded shoulderlike, embracing the last clitellar annulus, but prepucal fold only slightly developed; caudal end tapered to the sucker, for which it forms a definite peduncle; no lateral pulsatile vesicles and no other external metameric structures (nephropores, sensillae) discernible, except that intersegmental furrows are usually deeper than the others. Abdominal somites typically 3(6)-annulate but some of them definitely 6-annulate with the primary triannulation obscure, furrows often irregular or incomplete. Anus a well marked pore on the caudal peduncle followed by two incomplete annuli. Caudal sucker about twice size of cephalic in all dimensions, deeply cupped, regular, directed caudad, with about 48 minute marginal crenulations; dorsal face areolated and divided by faint furrows into three or four obscure concentric rings, each of which bears a circle of very minute papillae which are most distinct on the smooth ventral face. No natural color remains, but the type is stained a uniform green, which may be due to preservation in a copper tank.

Annulation (Fig. 1).—Often irregular and in places, especially at clitellum and caudal end of abdomen, difficult to interpret. On most somites primary and secondary furrows are distinguishable by their relative depth but in places this distinction is lost. I–V, cephalic sucker (head), no annuli distinguishable except some faint traces of one or two at caudal end. VI 2-annulate, first annulus (*a1 a2*) larger and very distinct, separated from sucker by a deep nuchal furrow, the second (*a3*) very small and not separated ventrally. VII 2 or 3-annulate, *a1* separated as a very short annulus on paratype, not distinct on type; furrows irregular and incomplete on both. VIII 3-annulate, similarly irregular, with split and spiral primary annuli. IX and X 3-annulate both dorsally and ventrally, *a3* largest on X with a faint secondary furrow. Normally X is first clitellar, but on these specimens apparently not closely united with XI externally. XI 2- or 3-annulate, definitely clitellar, (*a1 a2*) > *a3* with a faint *a1*/*a2* furrow on the dorsum, which disappears on the venter where *a3* is enlarged medially and produced caudad into XII as a small lobe bearing the ♂ gonopore on its caudal margin. XII 2- or 3-annulate, 3rd clitellar, similar to XI but shorter, more crowded, and partly concealed by XIII, *a1* less developed than on XI and *a3* possibly slightly subdivided, ♀ gonopore very minute at *a2*/*a3*, beneath prepucal fold on type. XIII 3-annulate, sharply defined by deep furrows from both XII and XIV and abruptly larger than former, with a moderately developed prepucal fold, which partly encloses it. XIV and XV 3-annulate, with *b5* and *b6* indicated on both paratype and type by a slightly developed *b5*/*b6* furrow and *b1* and *b2* on the former; owing to contraction the annuli of both crowded together and piled

up, making the region very opaque. XVI–XXII normally 3(6)-annulate. The normal condition is that the three primary annuli are approximately equal and each divided by shallower furrows into two secondary annuli, but because of different degrees of contraction of the two specimens and of greater or less engorgement of different gastric caeca of the same specimen there is much irregularity. On the type specimen the triannulate condition dominates but the shallower secondary furrows are usually present, especially on the more contracted side, where annuli stand out more prominently, but *a3* is rarely and *a2* more frequently undivided. On the paratype XVI to XIX are much distended by the large blood-filled caeca, which stretch the integument so that it is thin and transparent and the distinction between primary and secondary furrows is nearly lost (Fig. 1). This shows best on XVI and XVII. XVIII–XXII more typical, all annuli may be equal or *a2* smaller and *a3* larger. XXIII–XXV 3-annulate, but progressively reduced in size and the annulation very irregular, especially on the type. XXVI and XXVII 2-annulate, but irregular, the latter much smaller and bearing the anus on the anterior margin of the first annulus.

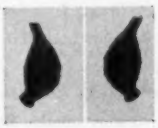


Fig. 4.—*Austrobdella anoculata*: Dorsal and ventral photographic views of type. × 3½.

Anatomy (Fig. 3).—Some of the internal organs can be seen through the integuments sufficiently to determine their position and roughly their form, but the details were worked out from sections of the paratype in which some of the structures were obscured by the engorged gastric caeca. Anatomy closely patterned after that of the genotype, *A. translucens*. Ventral nerve ganglia of complete somites in annuli *a2*, chiefly in *b4*. Pharynx with medial ventral and paired dorsolateral muscular ridges; salivary glands diffuse, of very large single cells in somites VII–X. Gastric caeca seven pairs in XIII to XIX, the first six reaching nearly to the lateral body walls and lobed at the ends, the last pair coalesced completely except at the caudal end, where the two caeca remain distinct for a longer distance than in *A. translucens;* intestine with two or three pairs of small simple caeca at the anterior end, following which it expands into a wide, simple sac reaching nearly to the end of the united gastric caeca and giving rise from its dorsal face a short distance anterior to its caudal end to a narrow, tubular rectum which ends at the anus. Reproductive organs similar to those of *A. translucens* except that the median chamber of the atrium is relatively smaller and the duct shorter; cornu large and sperm ducts with several loose coils at the atrial end; testes five pairs at XIV/XV to XVIII/XIX, alternating with gastric caeca. Vagina a simple vertical duct with only a slight enlargement and not expanded into a sac or bulb but encased in a mass of glands; it divides beneath the nerve cord into the paired ovarian sacs lacking the narrow duct and anterior lobe shown by Badham, both ovisacs very short, the one reaching to XIII only, the other to the middle of XIV, both containing developing ova in early stages.

Material examined.—Two specimens, one of which, the holotype, U.S.N.M. no. 20573, was obtained in 25 to 40 fathoms between Capes Alexander and Chalon, northwest Greenland, by Capt. Robert A. Bartlett, August 2, 1937 (station 27, seine haul). The other specimen, the paratype, comes from northeast Greenland, where it was collected by Captain Bartlett in 1930 (No. 14).

Remarks.—Owing to the limited material and its indifferent preservation, it has not been possible to arrive at such unequivocal conclusions and to prepare as satisfactory a description as could be wished. Many nominal species of fish leeches have been described from Arctic and sub-Arctic waters. Some of the early descriptions are so brief and ambiguous that the species to which they refer have never been certainly determined. Synonymies are still confused. It is possible that the species here described may belong to one of these, but none were found to agree. Concerning the generic reference there is little doubt. On a preliminary study it was thought that these leeches might belong to *Abranchus* or *Ottonia*, but externally the form and annulation differ from those genera and internally the coalescence of the last pair of gastric caeca is sharply differential.

On the other hand, the resemblance to *Austrobdella*, both externally and internally is very close. So far as it could be worked out, the annulation agrees closely with that of *A. translucens* Badham. The external form and proportions of parts are very similar. Neither of the two specimens is so strongly shouldered at the junction of the neck and abdomen as in Badham's most mature individuals. The anatomy of the alimentary canal and reproductive organs, so far as worked out, is very close in the two species, the principal differences being that in the type species the last pair of gastric caeca are more completely united at the caudal end than in *A. anoculata*, and that the ovisacs of the latter are not prolonged caudally and have the vaginal duct short and simple. These ovarian differences may be due to immaturity. Owing to the state of the material, a study of the distribution of the sinuses was not attempted.

ICHTHYOLOGY.—Hadropterus palmaris, *a new darter from the Alabama River System.*[1] REEVE M. BAILEY. (Communicated by LEONARD P. SCHULTZ.)

In a collection of fishes from the Etowah River in northern Georgia, six specimens of a hitherto undescribed species of *Hadropterus* were taken. Twenty-seven additional specimens from two localities in Alabama have been placed at my disposal through the generosity of Dr. Carl L. Hubbs.[2] This handsomely colored species is herein described under the name *Hadropterus palmaris*.[3]

[1] Received August 24, 1940. Journal Paper no. J791 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project no. 651.

[2] I am indebted to Dr. Hubbs for helpful suggestions in preparing this paper.

[3] *Palmaris* = a prize.

Hadropterus palmaris, new species Fig. 1

BRONZE DARTER

Holotype.—An adult male (Univ. Michigan Mus. Zool. no. 126179), 65.5 mm in standard length, collected in the Etowah River, known locally as the High Tower River (tributary to the Coosa River, tributary to the Alabama River), just above the bridge at U. S. Highway 19, 4 miles southwest of Dahlonega, Lumpkin County, Ga., on August 25, 1939, by Reeve M. and Marian K. Bailey (field no. B39:59).

Paratypes.—Five specimens were taken with the holotype: U.M.M.Z. no. 126180 (2), U. S. National Museum no. 117881 (2), Iowa State College no. 1 (1). U.M.M.Z. nos. 111232 and 111133 (23) collected in Saugahatchee Creek (tributary to the Tallapoosa River), Ala., October 24, 1930, by F. E. Guyton. U.M.M.Z. no. 111234 (4) collected 3 miles east of Tuskegee, Macon County, Ala., June 3, 1931, by F. E. Guyton.

Diagnosis.—A highly colored species of *Hadropterus* with moderate sized scales, 59 to 73 (usually 69 or fewer) along lateral line; nape and cheeks fully scaled; opercles imperfectly scaled (especially in adults); and midventral scales greatly enlarged in males. Dorsal XI to XIV-10 to 13, the soft portion high; anal II, 7 to 10; and pectorals 13 to 15. Preopercle entire. Gill membranes separated; the distance from their union to insertion of pelvic fins 0.75 to 0.95 in distance from tip of mandible to union of gill membranes. Snout short, 3.6 to 4.4 in head length. No subocular dark bar; dorsolateral surface punctated with dark; 2 large light spots at base of caudal.

Description.—The various body proportions (Table 1), fin-ray and scale-row counts (Table 2), and the photograph (Fig. 1) indicate clearly many of the characteristics of the species. The juveniles are seen to differ from the adults in their larger eyes, shorter snouts, and the somewhat greater distance between the union of the gill membranes and the tip of the mandible, but variations in body proportions within the species appear to be slight. The apparently broader interorbital width in the Alabama specimens seems to be due to preservation. In most of the fin-ray and scale-row counts (Table 2) the Alabama and Georgia specimens agree rather closely; but in lateral-line scale count the range of variation in the Alabama specimens is greater (59 to 73) than in those from Georgia (59 to 63). The increased number of pectoral rays in the Georgia specimens (average 14.8) as contrasted with those from Alabama (average 13.7) is notable.

The preopercle is entire, the horizontal arm scarcely longer than the vertical arm. The premaxillary frenum is slightly narrower than the thick, terminal, upper lip, and about two-thirds the diameter of the pupil. The moderately heavy mandibles are well separated, diverging but little for about three-fourths of their length from the symphysis, behind which they flare outward more sharply. The mandibular frenum is somewhat wider than the premaxillary frenum. The snout is bluntly decurved; the upper edge of the upper lips is on the level of the bottom of the eye, and the lower jaw is slightly included. In I.S.C. 1 the gill-rakers number 3+11, of which 1 above the angle and 4 below are very short. The longest gill-raker when depressed scarcely extends to the base of the second raker below. In the same specimen the vertebral count is 18+23=41 (hypural included); in the first caudal vertebra no haemal spine is developed but the haemal processes are united. The vomer bears a strong cluster of teeth, and the palatines are strongly toothed along their length. In *H. nigrofasciatus* the palatine teeth are few and restricted to the anterior portion of the bones.

TABLE 1.—MEASUREMENTS (TAKEN WITH DIVIDERS) OF 10 SPECIMENS OF HADROPTERUS PALMARIS[1]

Measurement	1	2	3	4	5	6	7	8	9	10
	Etowah River, Lumpkin County, Ga.			Saugahatchee Creek, Ala.	Etowah River, Lumpkin County, Ga.		Saugahatchee Creek, Ala.	Etowah River, Ga.	Saugahatchee Creek, Ala.	
	U.M.M.Z. 126180	U.S.N.M. 117881	Holotype U.M.M.Z. 126179	U.M.M.Z. 111233	I.S.C. 1	U.S.N.M. 117881	U.M.M.Z. 111233	U.M.M.Z. 126180	U.M.M.Z. 111233	
Sex	♂	♂	♂	♀	♂	♂	♀	♀	♀	♀
Standard length in mm.	68.5	67.5	65.5	63.5	63.0	61.5	61.0	46.5	38.0	36.0
In standard length:										
Depth of body	5.15	5.1	5.35	5.2	5.2	5.6	5.4	6.0	5.3	5.8
Length of head, including opercular membrane	3.7	3.8	3.75	3.95	3.9	3.8	3.8	3.8	3.65	3.7
In length of head:										
Width of body	2.1	2.05	2.0	1.7	1.95	2.05	1.75	2.1	1.85	1.95
Depth of caudal peduncle	2.7	2.6	2.55	2.55	2.6	2.55	2.7	2.65	2.9	2.8
Highest dorsal spine	2.8	2.7	2.5	2.8	2.5	2.85	2.9	3.1	2.6	2.6
Highest dorsal soft ray	1.8	1.7	1.65	1.75	1.8	—	1.75	2.1	1.9	1.85
Highest anal ray	1.85	1.6	1.6	1.55	1.7	1.65	1.55	1.65	1.85	1.8
Longest caudal ray	1.6	1.45	1.4	1.5	1.55	1.35	1.35	1.35	1.35	1.35
Longest pectoral ray	1.05	.95	.95	1.0	.95	1.0	1.05	1.0	1.1	1.0
Length of pelvic fin	1.1	1.05	1.05	1.15	1.1	1.1	1.2	1.1	1.2	1.2
Depth of head	1.6	1.6	1.65	1.65	1.6	1.7	—	1.8	1.8	1.7
Width of head	1.6	1.45	1.7	1.75	1.7	1.75	1.7	1.8	1.85	1.8
Length of eye	4.9	4.7	4.5	4.5	4.4	4.5	4.6	4.1	3.85	3.9
Length of snout	3.6	3.95	4.0	4.0	3.95	4.1	3.8	4.1	4.4	4.4
Length of upper jaw	3.4	3.6	3.7	3.4	3.65	3.7	3.4	3.7	3.85	3.75
In length of snout:										
Length of eye	1.4	1.2	1.15	1.1	1.15	1.1	1.3	1.0	0.95	0.95
In length of eye:										
Least fleshy interorbital width	1.5	1.5	1.6	1.25	1.7	1.5	1.35	1.6	1.5	1.45
In distance from tip of mandible to union of gill membranes:										
Distance from insertion of pelvic fin to union of membranes	0.85	0.75	0.8	0.8	0.8	0.85	0.85	0.95	0.95	0.9
Length of eye	2.4	2.3	2.2	2.2	2.15	2.35	—	2.2	1.85	1.95

[1] Largely following the format employed by Hubbs and Raney (1939, pp. 5–6) in their description of *H. oxyrhynchus* (Occ. Pap. Mus. Zool. Univ. Mich. no. 396, pp. 1–9, pl. 1).

TABLE 2.—FREQUENCY DISTRIBUTIONS OF FIN-RAY AND SCALE COUNTS[1] ON HADROPTERUS PALMARIS (the counts of the holotype are indicated by asterisks).

Locality	Dorsal spines				Dorsal soft rays[2]				Anal soft rays[2]				Caudal branched rays[3]		
	11	12	13	14	10	11	12	13	7	8	9	10	13	14	15
Georgia	—	1	5*	—	—	2	4*	—	—	1	5*	—	—	2	4*
Alabama	1	10	15	1	1	18	6	2	2	12	10	3	1	19	7
Total	1	11	20	1	1	20	10	2	2	13	15	3	1	21	11

Locality	Pectoral rays (both sides)			Scale rows								
				Above lateral line			Below lateral line					
	13	14	15	7	8	9	10	11	12	13	14	
Georgia	—	3*	9*	1	5*	—	3	2*	—	1	—	
Alabama	16	36	2	1	20	6	3	2	8	12	2	
Total	16	39	11	2	25	6	6	4	8	13	2	

Locality	Scale rows																			
	Along lateral line															Around caudal peduncle					
	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	20	21	22	23	24	25
Georgia	2*	—	1	—	3	—	—	—	—	—	—	—	—	—	—	—	2	1	2*	1	—
Alabama	1	5	2	2	1	5	2	3	1	1	2	1	—	—	1	1	6	4	13	2	1
Total	3	5	3	2	4	5	2	3	1	1	2	1	—	—	1	1	8	5	15	3	1

[1] The scales above the lateral line were counted downward and backward from the origin of the second dorsal fin; those below the lateral line were counted upward and forward from the origin of the anal fin; those along the lateral line were counted to the base of the caudal rays; those around the caudal peduncle represent a minimum enumeration.
[2] The last ray of the soft dorsal and anal fins was counted as double at the base.
[3] Seventeen principal caudal rays were counted in all specimens.

Five pores are given off by the lateral canal of the head, the anterior from a short downward projecting tube and the next three at the tips of long slender tubes, which project downward and backward. The supratemporal canal is complete, giving off a median pore from a short backward projecting tube, and one lateral pore on each side from longer and slenderer tubes that project backward and slightly downward. A single postorbital pore opens from a short backward projecting tube from the supraorbital canal on each side, and the interorbital pore of each side opens from a short tube that projects outward or outward and backward. The posterior nasal pore opens from a short tube just above the anterior end of the slitlike, posterior nostril. The anterior nasal pore lies anterodorsal to the tubular, anterior nostril. The coronal pore opens at the end of a long tube which may be curved slightly to the left or right. The infraorbital canal is complete with 8 pores; of which the anteriormost lies below and behind the anterior nostril, the second and third open from slender tubes near the edge of the maxillary groove, the

fourth emerges from a short upward projecting tube, and the posterior four open from long slender tubes that project downward and backward. Of the ten operculomandibular pores the six on the preopercle open from short, side tubes. The complete lateral line is very slightly arched anteriorly. (Nomenclature of canals and pores from Hubbs and Cannon, p. 10, pl. 2.[4])

The genital papilla of the adult male is a depressed and rounded, conical projection, which is smooth except for a short, longitudinal groove near its tip; that of the female is broadly semicircular, with several deep grooves radiating forward and outward from the orifice.

The pelvic fins are separated by a space equal to about four-fifths of the pelvic base. Between the pelvics there are two or three enlarged median scales, which may or may not be followed posteriorly by a naked strip for two-fifths of the length of the pelvic fins. In males the remainder of the midline of the belly is provided with a series of greatly enlarged scales with long and very strong ctenii; in females these scales are scarcely or not at all enlarged and the ctenii are little developed. There are one or two slightly to moderately enlarged scales at the union of the pelvic bones near the middle

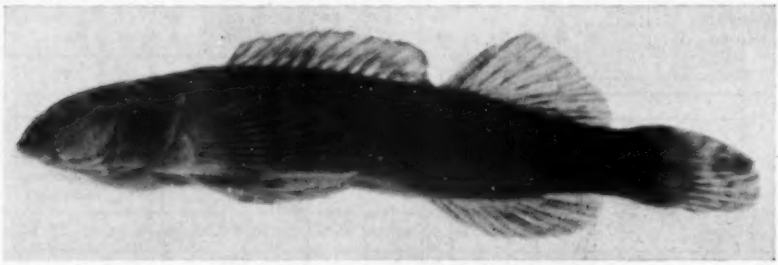


Fig. 1.—Paratype of *Hadropterus palmaris*, U.S.N.M. 117881, an adult male 67.5 mm in standard length, from the Etowah River, Ga. The photograph, of the right side of the fish but reversed in printing, was taken by Max E. Davis.

of the breast, and the subtriangular area between the pelvic bones is provided with small imbedded scales; otherwise the breast is entirely naked. The nape and cheeks are covered with well-developed imbricating scales; those of the cheek are in seven or eight rows as counted from the eye to the posteroventral angle of the preopercle. The opercles are provided with deciduous scales, varying from a complete absence of scales in some of the larger adults to an almost complete covering in juveniles. The holotype has five small, nonimbricate, imbedded scales on the left opercle and nine on the right.

The spinous dorsal is long and rather low and is narrowly separated from the soft dorsal. The soft dorsal and anal are large. The first of the two anal spines is much stronger but slightly shorter than the second. The margin of the caudal is slightly concave. The pectorals are broadest near their middle and extend as far back as the pelvics.

Coloration.—With the exception of *evides*, *palmaris* is the most colorful and handsome species of *Hadropterus* thus far described. In life the bodies of adult males were deep yellowish brown above, shading to dull olivaceous on the breast. On each side were eight to ten dark greenish-black vertical bars

[4] *The darters of the genera* Hololepis *and* Villora. Misc. Publ. Mus. Zool. Univ. Michigan, 30: 1–93, pls. 1–3. 1935.

(which retained their color in preservation), each considerably wider than the interspaces. These bars are usually continuous with their fellows across the back, especially anteriorly; and each narrows and fades ventrally, failing to cross the midventral line; those on the caudal peduncle extend somewhat lower than those on the body. In females the lateral blotches are longer than high and fail to ascend high on the sides. The bands are scarcely in contact with one another along the lateral line in some places; in others the contact is equal to the eye's breadth. The cheeks and lower portions of the opercles were (in life) dull yellowish green. The throats were iridescent with bluish-purple reflections; in preservation they are faintly dusky but less so than the mandibles. Unlike most species of the genus *Hadropterus* there is no trace of a subocular dark bar. A narrow dark band extends forward from the middle of the eye through the nostril, usually joining with that of the opposite side across the frenum. A dark bar extends backward from the eye across the upper part of the cheek to the anterodorsal corner of the opercle. A few dark spots are scattered on the dorsolateral surfaces of the back of the head, and somewhat larger dark spots are present between the lateral bars on the dorsolateral surfaces of the body.

In life the spinous dorsal was light near the base, with a rich chocolate-brown spot on each interradial membrane. This light area was succeeded distally by a dusky band, which shaded gradually into a rich reddish-orange band occupying most of the distal half of the fin, which was sharply and narrowly edged with clear white. In preservation the white edging and the dusky band are evident in the otherwise uniformly faint pigmentation. The soft dorsal was dull orange-yellow, with a narrow light border; a few scattered dark radial spots tend to form rows about one-third and two-thirds of the distance from the base, but in some specimens they are faint or obsolete. At the base of the caudal there are two large light spots (each about size of eye), which were pale yellowish orange in life. Three wavy vertical bars on the caudal are formed by pigment confined to the rays. The caudal, anal, pectorals, and pelvics were suffused with dull yellow in life, and all had light distal edges. In preservation the basal half of the anal is faintly dusky; the pelvics have a few median dusky spots; and each pectoral has a narrow curved bar just proximad of the middle.

The color description given above was drawn from the Georgia specimens. Juveniles from Saugahatchee Creek, Ala., vary greatly in body pattern. Some differ but little from the adults, whereas others are heavily and irregularly mottled with dark on the sides and the lateral series of blotches are scarcely or not at all developed.

Habitat.—The Etowah River is an upland stream (elevation at site of collection about 1,300 feet), which at the time of the collection was clear, colorless, cool (67° F.), and with a moderate to swift current. It varied from about 35 to 60 feet in width, and the flow, estimated at 250 cubic feet a second, was somewhat greater than normal owing to recent rains. The bottom was composed largely of sand, with coarse gravel and slab-rubble riffle areas. Vegetation was limited to slight algal growth on the stones.

All the specimens of *H. palmaris* were taken on a swift riffle, which was about 6 feet long and extended the width of the stream. It varied from a few inches to over a foot in depth. Common associates of *H. palmaris* on the riffle were *Poecilichthys jordani* and *Cottus zopherus* (probably this species although

the lateral line is nearly or quite complete). Other species taken in the collection were *Moxostoma* sp., *Hypentelium etowanum*, *Notropis callistius*, *N. x. xaenocephalus*, *N. trichroistius*, and *Micropterus coosae*. Local residents reported that rainbow trout occurred in the stream, but none were collected. No habitat data are available for the Alabama collections.

Relationships.—*H. palmaris* differs trenchantly from all other known species in the genus in coloration and color pattern; especially distinctive are the pattern of the spinous dorsal, the uniform absence of a subocular bar, and the presence of dark spots on the anterior back and of two round light spots at the base of the caudal. It differs from *macrocephalus*, *phoxocephalus*, and *oxyrhynchus* especially in the blunter snout, the shorter distance from the tip of the snout to the union of the gill membranes (see Hubbs and Raney, loc. cit.), and in the larger scales. In its entire preopercle, *palmaris* contrasts with *H. scierus*. The Atlantic drainage species, *pellatus* and *roanoka*, differ from *palmaris*, among other respects, in the larger scales and in the absence of scales on the nape. *H. maculatus* and *H. palmaris* are quite similar in form, although in *maculatus* the soft dorsal and anal are much lower, but *maculatus* typically lacks scales on the predorsal area, and has more perfectly scaled opercles than *palmaris*. On the basis of color pattern *H. palmaris* is separable at a glance from *H. nigrofasciatus*, the only other described species of the genus from the Alabama basin. It also differs from that species in the imperfect squamation of the opercles, the much larger and more specialized midventral scales of the males, and in the stronger fin spines, especially the first anal spine. Although *palmaris* lacks the characteristic subocular dark bar of *evides*, the two species share certain features of coloration. Both have paired light spots at the base of the caudal, lateral blotches which are similar in shape and color and agree in continuing upward to cross the back, and each is highly colored in life. *H. evides* is a heavier and more robust species, and in it the spinous dorsal is conspicuously higher and more rounded, and the soft dorsal lower than in *palmaris*. The absence of cheek scales in *evides* and the imperfect squamation of the opercles in *palmaris* are clear-cut differentiating features.

H. palmaris seems to share more similarities with *evides* than with other species, the two apparently standing somewhat apart from the remaining species in the genus.

ICHTHYOLOGY.—*The remora* Phtheirichthys lineatus *and the first specimen from United States waters.*[1] HUGH M. SMITH, U. S. National Museum.

In the year 1791 there appeared two descriptions of a new remora called *Echeneis lineatus* by Archibald Menzies in Transactions of the Linnean Society, London (vol. 1, p. 187, pl. 17, fig. 1), and *Echeneis tropica* by Bengt Anders Euphrasén in Kongliga Vetenskaps Academiens Nya Handlingar, Stockholm (vol. 12, p. 317). The habitat of *E. lineata* was stated to be the Pacific Ocean between the tropics, and the single specimen 5 inches long on which the description was based was found adhering to a turtle. For *E. tropica* the locality given was latitude 2° 9′ N., longitude 20° 49′ W. from Paris, a place in the Atlantic Ocean about 600 miles southwest of that part of Africa now known as Liberia, and the single specimen mentioned was discovered attached to the nautical log of a ship when the log was pulled aboard.

These two names have generally been regarded as applying to the same species, and there is certainly nothing in the original descriptions to indicate specific distinctness. The outstanding character is the possession of only 10 laminae in the cephalic disk, combined with features that are shared with the common remora *Echeneis naucrates*, such as the very elongate body, ventral fins narrowly adnate to the abdomen, angulate pectoral fins, middle caudal rays produced in the young, and strongly projecting lower jaw with a cutaneous symphyseal flap. In 1862 Gill (Proceedings of the Academy of Natural Sciencies of Philadelphia) created the genus *Phtheirichthys* and designated *Echeneis lineata* Menzies as the type.

With two specific names for the same fish coming into use in the same year, there arises the question of the proper one to adopt. While the question may not be definitely settled by the internal evidence afforded by the respective publications, there is ground for a reasonably satisfactory decision affecting both priority and convenience.

The Nya Handlingar in which Euphrasén's *Echeneis tropica* was described (in a paper entitled "Scomber atun och Echeneis tropica beskrisne") was issued in quarterly parts with consecutive pagination, the paper appearing in the part for October, November, and December 1791. It is improbable that the part was printed and distributed before the last quarter of 1791; it is possible that it was not issued until the last month of that quarter or even the beginning of the next quarter.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received September 25, 1940.

Menzies's paper, "Description of Three New Animals Found in the Pacific Ocean," was read before the Linnean Society on April 6, 1790, and was followed by papers by other authors read in October, November, and December, 1790, and March, 1791, and was preceded by papers read in 1788, 1789, and 1790, with an addendum to one of the papers bearing date of February 6, 1791. The plate accompanying the paper contains, in addition to a figure of the remora, figures of a worm and a leech described by Menzies and four figures of insects referred to in a paper by another author. The make-up and general appearance of the volume strongly indicate that it was published as a whole, and there is nothing to suggest that any of the papers were issued as separates; indeed, such issuance was practically precluded by the fact that figures illustrating papers by two different authors appeared on the same plate. The title page of the volume bears date of 1791, and it may be safely inferred that the volume was issued in the first half of that year.

But even if it can not be conclusively shown from the evidence at hand that the name *Echeneis lineatus* has priority over *Echeneis tropica*, it may be proper, and it is certainly desirable, to render a decision in favor of the former because the description was accompanied by an illustration and because *lineatus* was designated as the type of a new genus.

The first mention of this fish as an inhabitant of the coastal waters of the United States was by Jordan and Gilbert (Proc. U. S. Nat. Mus. **5**:591. 1882), who recorded a specimen 4 inches long taken by Gilbert at Charleston, S. C., in July–August, 1882. This specimen, apparently no longer in existence, was fully described and was the basis for the statement in Jordan and Gilbert's *Synopsis of the fishes of North America* (1883) that the species ranges in "tropical seas, north to South Carolina." In Jordan and Evermann's *Fishes of North and Middle America* (part 3, 1898) the species is reported to range also to Pensacola, although in Evermann and Kendall's *Check-list of the Fishes of Florida* (1900), which included "all salt-water species known from Florida within the depth limit of 1,000 fathoms," this remora is not listed. In the *Check List of Fishes and Fishlike Vertebrates of North and Middle America* (1930), by Jordan, Evermann, and Clark, the species appears under the name *Phtheirichthys tropicus*, without mention of *P. lineatus* as a synonym.

It now remains to present a record of what appears to have been the first specimen of *Phtheirichthys lineatus* taken in United States waters. A short time ago Dr. Leonard P. Schultz, curator of fishes in

the United States National Museum, found in the National collection a fish labeled *Rhombochirus osteochir*, which proved to be a *Phtheirichthys* indistinguishable from the form described and figured by Menzies. The specimen came from Woods Hole, Mass., was obtained in 1871 by Vinal N. Edwards, the indefatigable collector of the United States Fish Commission, and was catalogued in 1876, bearing the number 20331 in the Museum register. In view of my special interest in the fish fauna of the Woods Hole region, Dr. Schultz has kindly permitted me to make known the existence of this specimen, which is apparently the first and only one reported from our northeastern coast. The specimen, in an excellent state of preservation, is 15.6 cm long, with discal laminae numbering 10, dorsal rays 31, and anal rays 30, and, although nearly 60 years in alcohol, it still shows the two whitish longitudinal stripes along the side as represented in Menzies's plate and embodied in his specific name.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE ACADEMY

363D MEETING OF THE BOARD OF MANAGERS

The 363d meeting of the Board of Managers was held in the Board Room of the Cosmos Club on Friday, October 11, 1940. President CRITTENDEN called the meeting to order at 8:03 P.M. There were 15 present, as follows:

E. C. CRITTENDEN	J. H. HIBBEN	W. RAMBERG
F. D. ROSSINI	G. STEINER	E. W. PRICE
F. C. KRACEK	F. M. SETZLER	C. L. GARNER
H. S. RAPPLEYE	A. T. MCPHERSON	and by invitation
H. C. FULLER	A. H. CLARK	J. H. KEMPTON
	C. THOM	

President CRITTENDEN appointed the following Committee of Tellers to count the ballots on the three proposed amendments to the bylaws, which were submitted to vote of the membership on October 7: H. N. EATON, chairman; R. S. JESSUP; B. J. MAIR; CHARLES MOON, alternate.

Chairman GARNER reported for the Committee on Meetings that the following program of meetings has been arranged for the Academy for the season October to April, inclusive:

October 17, 1940. Dr. W. F. G. SWANN, director of the Bartel Research Foundation of the Franklin Institute, Swarthmore, Pa., on "The Laws of Nature."

November 28, 1940. Dr. VERGIL REED, assistant director of the U. S. Bureau of Census, on "The Human Side of the Census."

December 19, 1940. Dr. W. C. LOWDERMILK, chief of the Division of Research of the U. S. Forest Service. Title not yet announced.

January 16, 1941. Annual meeting and presidential address.

February 20, 1941. Dr. P. W. BRIDGMAN, professor of physics at Harvard University, Cambridge, Mass. Title not yet announced.

March 20, 1941. Awards for scientific achievement.

April 17, 1941. Tentatively, Commander F. W. REICHELDERFER, chief of the U. S. Weather Bureau.

The date for the November meeting was changed to the 28th because the 21st is Thanksgiving Day. The October and November meetings are scheduled to be held in the Assembly Hall of the Cosmos Club, as in the past. Commitments for the following months will be made later.

On recommendation by the Committee on Membership, who submitted the names at the last meeting of the Board, 17 persons were considered individually and duly elected to membership.

Mr. SETZLER presented the report of the Special Committee, of which he is chairman with R. E. GIBSON and R. R. SPENCER members, on Society Affiliation with the Academy. The committee considered the list, published in Vol. 30, No. 1, Jan. 15, 1940, of the JOURNAL, of societies not affiliated with the Academy and recommended action on organizations representing disciplines having a small active stable membership within the District of Columbia. The report was accepted by the Board, and the committee was instructed to report in detail on the Washington Section of the American Institute of Mining and Metallurgical Engineers; the Washington Chapter of the American Institute of Metals, and the Washington-Baltimore Psychoanalytic Association.

The secretary reported the following status of Academy membership:

	Resident	*Nonresident*	*Total*
Active	420	127	547
Retired	30	13	43
Honorary	3	14	17
Patrons	—	2	2
Total	453	156	609

Cognizance being taken of present commitments in the form of nominations, acceptances, etc., there is a minimum of 22 vacancies in the resident membership and of 5 in the nonresident membership.

The Board adjourned at 9:18 P.M.

ELECTIONS TO MEMBERSHIP

The following were recently elected to resident membership:

ERNEST ADNA BACK, principal entomologist, U. S. Bureau of Entomology and Plant Quarantine, in recognition of his contributions relating to the control of attacks of insects on stored products and to the biology and control of citrus white flies.

NATHAN LINCOLN DRAKE, professor of organic chemistry, University of Maryland, in recognition of his contributions to organic chemistry, in particular his researches on the constitution of the polyterpenoids.

LYNDON FREDERICK SMALL, head chemist, National Institute of Health, in recognition of his studies on morphine derivatives.

R. CLIFFORD HALL, principal forester, U. S. Forest Service, in recognition of his researches and investigations on forest policy and forest tax problems.

WALTER J. HAMER, associate chemist, National Bureau of Standards, in recognition of his work on hydrogen ion concentration, in particular his in-

vestigations on the thermodynamics of sulphuric-acid solutions and the development of a pH method using galvanic cells without liquid junctions.

VERNE LESTER HARPER, senior silviculturist, U. S. Forest Service, in recognition of his contributions to oleoresin production in pines, in particular the effect of weather and soil factors on gum flow.

JAY P KINNEY, supervisor of work program, Indian Service, U. S. Office of Indian Affairs, in recognition of his contributions to forest law and history and to the improvement of forest management on Indian lands.

JACOB KOTZ, clinical professor of obstetrics and gynecology, George Washington University, in recognition of his contributions to endocrinology.

JOSEPH THOMAS PARDEE, senior geologist, U. S. Geological Survey, in recognition of his contributions to the geology of metalliferous deposits (including manganese) in the Northwestern States.

ELIZABETH PARKER BARTSCH, physician, clinical instructor in obstetrics and gynecology, George Washington University, in recognition of her researches in female endocrinology.

RAYMOND PRICE, senior forest ecologist, U. S. Forest Service, in recognition of his researches relating to forest and range lands, particularly in connection with range management, artificial revegetation, and plant nutrition.

FREDERIC G. RENNER, chief of the division of range conservation, U. S. Soil Conservation Service, in recognition of his researches on erosion control and watershed protection on forest ranges and other range lands.

OSCAR WILLIAM TORRESON, observer, Department of Terrestrial Magnetism, Carnegie Institution of Washington, in recognition of his investigations in atmospheric electricity.

RICHMOND TUCKER ZOCH, associate meterologist in charge of library, U. S. Weather Bureau, in recognition of his contributions to mathematical hydrology.

The following was recently elected to nonresident membership:

GEORGE BURTON RIGG, professor of botany, University of Washington, Seattle, Wash., in recognition of his contributions to plant physiology, in particular his researches on the physiology and ecology of sphagnum-bog vegetation.

CHEMICAL SOCIETY

512TH MEETING

The 512th meeting was held in the School of Government Building of George Washington University on Thursday, October 12, 1939, President KRACEK presiding. After the completion of routine business the following communications were presented in three sections:

Inorganic and Analytical Chemistry, C. R. NAEBER presiding

F. W. SCHWAB and E. WICHERS: *The Preparation of Benzoic Acid of High Purity.*

A. K. BREWER: *A Thermal Method for the Separation of Isotopes.*

F. W. GLAZE and A. N. FINN: *A Modification of the Partition Method for Determining Boron in Glass.*

Organic and Biological Chemistry, C. M. MACKALL presiding

L. D. GOODHUE and H. L. J. HALLER: *Recent Progress in the Chemistry of Derris.*

M. B. MATLACK: *The More Important Aspects of Our Work on Lipase and Esterase.*

L. A. SHINN and B. H. NICOLET: *The Action of Periodic Acid on Amino Alcohols and Amino Acids.*

Physical Chemistry, M. H. VAN HORN presiding

S. BRUNAUER and P. H. EMMETT: *Chemisorptions of Gases on Iron Synthetic Ammonia Catalysts.*

A. BRENNER: *The Electrodeposition of Copper-Bismuth Alloys from a Perchlorate Bath.*

C. K. HORNER and D. BURK: *The Catalytic Function of Molybdenum in Nitrogen Fixation by Azotobacter.*

513TH MEETING

The 513th meeting was held in the auditorium of the East Building of the National Bureau of Standards on October 26, 1939, President KRACEK presiding. Following the completion of routine business, the Society was addressed by H. MARK, formerly of the University of Vienna, on *The Elastic Behavior of High Polymeric Substances.*

514TH MEETING

The 514th meeting was held in the auditorium of the Cosmos Club on November 9, 1939, President KRACEK presiding. The Society was addressed by EARL P. STEVENSON, president of Arthur D. Little Co., of Cambridge, Mass., on the subject *Research in Industry.* Elections were held for the officers for the Society for the year 1940. The following were elected: President, R. M. HANN; Secretary, NORMAN BEKKEDAHL; Treasurer, E. R. SMITH; Councilors, F. G. BRICKWEDDE, N. L. DRAKE, R. GILCHRIST, H. T. HERRICK, G. E. HILBERT, B. H. NICOLET, B. D. VAN EVERA; Managers, M. M. HARING, S. B. HENDRICKS, J. T. SCANLAN, S. T. SCHICKTANZ, L. A. SHINN, H. P. WARD.

515TH MEETING

The 515th meeting was held in the auditorium of the Cosmos Club on November 30, 1939, President KRACEK presiding. Following the completion of routine business, the Society was addressed by ROBERT E. LUTZ, of the University of Virginia, on *Some Recent Work on Furans and Hydroxyfuranones.*

516TH MEETING

The 516th meeting was held in the auditorium of the Cosmos Club on December 14, 1939, President KRACEK presiding. Following the completion of routine business, the Society was addressed by W. FRANKENBURG on *Relations Between Photochemical and Catalytic Processes.*

517TH MEETING

The 517th meeting was held jointly with the Washington Academy of Sciences in the auditorium of the Cosmos Club on December 21, 1939. The President of the Academy, CHARLES E. CHAMBLISS, introduced B. F. NICOLET, Resident Vice-President of the Academy, who presented the speaker of the evening, C. S. MARVEL, professor of organic chemistry of the University of Illinois. Dr. Marvel addressed the meeting on *Plastic Glasslike Resins (Vinyl Polymers).*

518TH MEETING

The 518th meeting (56th annual meeting) was held in the auditorium of

the Cosmos Club on January 11, 1940, President HANN presiding. After the reading of reports of the officers and committees for 1939 and the completion of other routine business, the Society was addressed by the retiring President, FRANK C. KRACEK, who spoke on *Some Chemical Aspects of Order-Disorder Phenomena.*

519TH MEETING

The 519th meeting was held in the auditorium of the Cosmos Club on February 8, 1940, President HANN presiding. Following the completion of routine business, the Society was addressed by L. MICHAELIS, of the Rockefeller Institute for Medical Research, New York City, on *Reversible Oxidation-Reduction in Organic Compounds and Semiquinone Radicals.*

520TH MEETING

The 520th meeting was held in the auditorium of the Cosmos Club on March 14, 1940. The occasion was the annual banquet of the Society, and 119 members and guests gathered together to celebrate the awarding of the Hillebrand Prize to R. E. GIBSON, of the Geophysical Laboratory, Carnegie Institution of Washington, for this excellent work, *The Behavior of Solutions Under High Pressures.* President HANN acted as Toastmaster. He first introduced L. H. ADAMS, the director of the Geophysical Laboratory, who spoke on *Some Significant Aspects of High-Pressure Research.* Following this, Past-President KRACEK introduced the recipient of the award, Dr. GIBSON, who was then presented with the certificate by Dr. HANN. Dr. GIBSON then addressed the Society, giving a résumé of his work in the field of the behavior of solutions under high pressures.

521ST MEETING

The 521st meeting was held in the auditorium of the Cosmos Club on March 28, 1940, President HANN presiding. Following the completion of routine business, the Society was addressed by PHILLIP ABELSON, of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, who spoke on *Indentification of the Products of Uranium Fission.*

522D MEETING

The 522d meeting was held in the auditorium of the Cosmos Club on April 11, 1940, S. B. HENDRICKS presiding in the absence of President HANN. The Society was addressed by two members of the National Institute of Health:

SANFORD M. ROSENTHAL: *Experimental Studies upon Sulphanilamide and Related Compounds.*

HUGO BAUER: *Chemical Structure of Some Arsenic and Phosphorous Compounds Active against Bacterial Infections.*

523D MEETING

The 523d meeting was held in the auditorium of Engineering Building, University of Maryland, College Park, Md., President HANN presiding. H. S. ISBELL and C. E. WHITE were elected to the Board of Managers to fill vacancies arising from the resignations of J. T. SCANLAN and S. T. SCHICKTANZ. After the completion of other routine business, the following communications were presented in three sections:

Physical Chemistry, M. M. HARING presiding

J. STEINHARDT and M. HARRIS: *Role of Anions and of Undissociated Acids in the Combination of Acids with Proteins.*

D. V. SICKMAN and W. P. RATHFORD: *Induced Chains and the Mechanism of the Thermal Decomposition of Acetaldehyde.*

E. R. SMITH: *Limitations of the Polarographic Method of Analysis.*

Organic and Biological Chemistry, N. L. DRAKE presiding

W. H. SEBRELL and F. S. DAFT: *Vitamin B_2 Complex Deficiencies.*

J. J. STUBBS, L. B. LOCKWOOD, E. T. ROE, B. TABENKIN and G. E. WARD: *Production of Ketogluconic Acids from Glucose by Acetic-Acid Bacteria.*

S. N. WRENN and C. I. POPE: *Reaction of Acetals with Anhydrous Hydrogen Bromide.*

Analytical and Inorganic Chemistry, W. J. SVIRBELY presiding

C. E. WHITE: *Fluorescence Analysis of Aluminum and Thorium.*

W. D. MOGERMAN and J. A. SCHERRER: *Determination of Tin in Nonferrous Alloys by the Distillation-Cupferron Method.*

W. O. ROBINSON: *The Occurrence of Rare Earths in the Leaves of Hickory and a Few Other Plants.*

NORMAN BEKKEDAHL, *Secretary*

BOTANICAL SOCIETY

301ST MEETING

The 301st regular meeting was held in the assembly hall of the Cosmos Club, December 5, 1939, Vice-president CHARLOTTE ELLIOTT presiding; attendance 100.

Notes and reviews.—M. B. WAITE called attention to the fact that he had found a butternut tree (*Juglans cinerea*) growing on the Coastal Plains, near Walshs Grove, 1 mile from Priests bridge on the Patuxent River. He also displayed a puffball, *Calastoma cinnabarinum*, which he had collected on his farm growing among sphagnum and ferns and a rare climbing fern, *Lygodium palmatum*, which was growing in his apple orchard among dead golden-rods. It is related to *Schizaea*.

Program.—PHILLIP BRIERLY: *Mosaic of lilies.*—Two viruses can be isolated from Easter lilies (*Lilium longiflorum* Thunb.) affected with necrotic fleck mosaic: A strain of cucumber virus I and a virus similar to McWhorter's latent virus of lily. Tulip viruses such as McWhorter's latent type fail to infect tobacco, and cucumber-virus strains are not recovered when necrotic fleck is passed through tulip. Tulips inoculated with cucumber virus develop leaf and flower symptoms distinct from the usual breaking of tulips. Easter-lily seedlings show mild symptoms or none following inoculation with latent virus only, and none with cucumber virus only; under some conditions they develop fleck when cucumber virus is superimposed on latent virus. The coarse mottle mosaic of Easter lily yields a tulip virus but no cucumber virus. *Lilium formosanum* Stapf expresses symptoms on inoculation with tulip viruses including that which is latent in Easter lily and other species. This species is a convenient substitute for tulip in indexing lilies for the presence of tulip virus. With this species and tobacco used as test plants, cucumber and tulip viruses have been shown generally distributed both separately and in double infections in many lily species in gardens.

CHARLES THOM: Address of the retiring president, *Naming molds*, published in full in this JOURNAL, vol. 30, no. 2, February 15, 1940.

ALICE M. ANDERSEN, *Recording Secretary*

Obituary

FREDERICK EUGENE FOWLE was born in Arlington, Mass., on November 20, 1869, the son of Frederick E. and Mary Proctor Fowle. He died at Washington, D. C., on April 23, 1940. A precocious youth, he early undertook the study of music and languages, becoming proficient in both. His formal education was completed at the Massachusetts Institute of Technology, from which he was graduated in 1894.

As a young man he was for several years assistant at the Harvard College Observatory, but after graduation from the Massachusetts Institute of Technology he accepted a position at the Smithsonian Institution, where he spent more than 40 years in the measurement and study of the radiation of the sun. He was coauthor in Volumes 1 to 5 of the Annals of the Astrophysical Observatory, and he devised methods of measuring the total atmospheric contents of water vapor and of ozone. He made valuable researches on the influence of these vapors on the income and outgo of radiation through the atmosphere which will long be referred to. Not less valuable was his assembly and editorship of the Smithsonian Physical Tables, a reference work that he made invaluable in these days of rapid discovery of the physics of the atom and the extension of the universe. Nearly 20,000 copies of this book went into the hands of research men during his editorship, and received universal praise for broadness and accuracy.

By his first wife, Susie Gates, of Arlington, Mass., Mr. Fowle had two children, who survive him. In 1930 he married Juliana Thomasson, of North Dakota, who also survives him.

FRANCIS RANDALL HAGNER died suddenly on July 7, 1940, at his home, 1824 Nineteenth Street, NW., Washington, D. C. Dr. Hagner was born in Washington in 1873, the son of Dr. Charles E. and Mrs. Isabella Davis Hagner. His family had long been prominent in the affairs of Maryland and the District of Columbia. He received his preliminary education at the Emerson Institute. In 1894 he was graduated from the School of Medicine of the Columbian College, now George Washington University. After graduation he went to Johns Hopkins Hospital, becoming assistant resident in surgery. In 1896 he returned to Washington to practice medicine. For a time he carried on a general practice, but after a few years he began to specialize in urology.

He was appointed professor of genitourinary surgery at the George Washington University School of Medicine in 1905, which position he held until his retirement in 1939 when he became professor emeritus. Dr. Hagner will be remembered as a successful teacher and leader in his field. Many of his students through his influence, have specialized in the field of urology.

Many honors came to him in the field of medicine, and he served as president of the American Association of Genitourinary Surgeons, the Clinical Society of Genitourinary Surgeons, the Clinico-Pathological Society of the District of Columbia, and the Medical Society of the District of Columbia. He was a life member of the American College of Surgeons, a fellow of the American Medical Association, and a member of the American Urological Association and the Southern Surgical Association.

Dr. Hagner invented numerous devices and made marked advances in procedures involved in his specialty and wrote many medical articles relative to it.

Among Dr. Hagner's many interests one of the outstanding was his prolonged and thorough study of the life of John Wilkes Booth and of the circumstances surrounding the assassination of President Lincoln. He was

deeply interested in the collection of etchings and early Western Americana. He was a member of the Washington Academy of Sciences, the Biological Society of Washington, and the Columbia Historical Society.

He was possessed of a charming personality which won him hosts of friends and admirers both in Washington and wherever he was known. He was one of the most beloved as well as one of the most distinguished physicians of our time.

Dr. Hagner married Miss Elizabeth Allemong of Charleston, W. Va., in 1898. She and a sister, Mrs. Norman James of Baltimore, survive him.

INDEX TO VOLUME 30

An asterisk (*) denotes the abstract of a paper presented before the Academy or an affiliated society.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

Anthropological Society of Washington. 317.
Botanical Society of Washington. 318, 538.
Chemical Society of Washington. 535.
Geological Society of Washington. 485.
Philosophical Society of Washington. 398.
Washington Academy of Sciences. 46, 134, 174, 276, 317, 448, 484, 533.

AUTHOR INDEX

ALLARD, H. A. The starling's family life and behaviors. 34.

——— and H. F. ALLARD. The wild bean *Phaseolus polystachyus* (L.) B. S. P.: Its chromosome number. 335.

ALLARD, H. F. See H. A. ALLARD. 335.

AVERY, JOHN LAWRENCE. Studies on the egg-laying habits of the fairy shrimp. 31.

AXELROD, DANIEL I. The Pliocene Esmeralda flora of west-central Nevada. 163.

BAILEY, REEVE M. *Hadropterus palmaris*, a new darter from the Alabama River System. 524.

BARTH, TOM F. W. *Geysers and other hotsprings in Iceland. 398.

——— *Thermal activity in Iceland. 497.

BARTRAM, M. THOMAS. *An early American botanist, John Bartram 1699–1777. 454.

BEIJ, K. H. *Model testing at the National Hydraulic Laboratory. 399.

BERKNER, L. V. *Fluctuations in the earth's outer atmosphere during a great magnetic storm. 400.

BERRY, EDWARD W. A *Cusparia* from the Pliocene of trans-Andean Bolivia. 464.

——— Additions to the Pensauken flora. 132.

BLAISDELL, DOROTHY. *Variability studies in the tomato *Fusarium* wilt organism; cultural studies. 452.

BLAKE, S. F. *Early American botanists, John Bannister (1650–1692), John Clayton (1686–1773), Humphrey Marshall (1722–1801). 454.

——— New species and new names among Arizona Asteraceae. 467.

——— *Paralbula*, a new fossil fish based on dental plates from the Eocene and Miocene of Maryland. 205.

BRACKETT, F. S. *Spectroscopic methods and their importance in biological research. 404.

BRIERLY, PHILLIP. *Mosaic of lilies. 538.

BRIESE, R. R. See JAMES F. COUCH. 413. See E. A. MORAN. 237.

BROWN, D. E. See W. M. LUNN. 319.

BROWN, ROLAND W. A bracket fungus from the late Tertiary of southwestern Idaho. 422.

——— Fossil pearls from the Colorado group of western Kansas. 365.

——— New species and changes of name in some American fossil floras. 344.

BULLER, A. H. REGINALD. *The sexual process in the rust fungi. 454.

CARLGREN, OSKAR. Actiniaria from Alaska and Arctic waters. 21.

CASH, EDITH K. A second note on Georgia Discomycetes. 299.

——— See M. L. LOHMAN. 255.

CHAMBLISS, CHARLES E. The botany and history of *Zizania aquatica* L. ("wild rice"). 185.

CHAPIN, EDWARD A. New genera and species of lady-beetles related to *Serangium* Blackburn (Coleoptera: Coccinellidae). 263.

CHARLES, VERA K. A ringworm disease of muskrats transferable to man. 338.

CLAUSEN, CURTIS P. The oviposition habits of the Eucharidae (Hymenoptera). 504.

COKER, R. E., and JUANITA MORGAN. A new harpacticoid copepod from North Carolina. 395.

COLE, P. A. *Determination of cell structure by means of the ultraviolet microscope. 405.

COLLINS, W. D. *Water analyses. 496.

COOK, O. F. Aublet the botanist, a pioneer against slavery, with a memorial genus of palms. 294.

COUCH, JAMES F., and REINHOLD R. BRIESE. Cyanogenesis and enzyme activity in sorghum varieties. 413.

——— See E. A. MORGAN. 237.

CREASER, EDWIN P. A new species of phyllopod crustacean from Stone Mountain, Georgia. 435.

DORF, ERLING. *The stratigraphic significance of the flora of the type Lance formation. 486.

DRECHSLER, CHARLES. Three fungi destructive to free-living terricolous nematodes. 240.

DU TILLY, ARTHENE. *Botanical exploration in the Canadian Arctics. 452.

DYSON, JAMES L. *Structure and motion of cirque glaciers. 489.

EVERITT, EDWARD L., and M. X. SULLIVAN. The bacteriostatic and the bactericidal action of certain organic sulphur compounds. 457.

——— The fungistatic and fungicidal action of certain organic sulphur compounds. 125.

FENNELL, J. L. Two new North American species of *Vitis*. 15.

FERGUSON, FREDERICK F. See WAYLAND J. HAYES, JR. 27.

FOSTER, MARGARET D. *Geochemical relations of ground waters in the Houston-Galveston area, Tex. 490.

FOX, FRANCES E. *Supersonics in liquids. 402.

FOX, IRVING. Siphonaptera from Western United States. 272.

GABRIELSON, IRA N. *Western American alpine plants. 453.

GAGER, C. STUART. *How botany advances. 455.

GAMOW, G. *Uncertainties in atomic and common life. 403.

GARDNER, LOUIS S. *Displacement along the Hurricane fault in Utah and Arizona. 492.

GARNER, W. W. See W. M. LUNN. 319.

GOODDING, CHARLOTTE O. Two new species of *Muhlenbergia*. 19.

GRAVATT, G. F. *Effect of epidemic tree diseases on the food supplies of animals. 451.

GRIGGS, DAVID. *Convection currents and mountain-building. 494.

HAGEN, JOHN P. *Beam power tubes as ultra-high radio frequency generators. 411.

HARLAND, S. C. Taxonomic relationships in the genus *Gossypium*. 426.

HARTMAN, OLGA. *Boccardia proboscidea*, a new species of spionid worm from California. 382.

HAYES, WAYLAND J., JR., and FREDERICK F. FERGUSON. Notes on the morphology of *Macrostomum ruebushi* var. *schmitti*. 27.

HEDGPETH, JOEL W. A new pycnogonid from Pescadero, Calif., and distributional notes on other species. 84.

HERMANN, F. J., T. H. KEARNEY, and R. H. PEEBLES. Arizona plants: New species, varieties, and combinations. 217.

HEWETT, D. F. New formation names to be used in the Kingston Range, Ivanpah quadrangle, California. 239.

HOERNER, G. R. A nomenclatorial note on *Pseudoperonospora*. 133.

HUBBARD, J. C. *Ultrasonics and the ratio of specific heats of gases. 401.

HULL, FRANK M. Some new species of Syrphidae (Diptera). 432.

INGRAM, WILLIAM M. A new *Gisortia*. 376.

JENNESS, DIAMOND. Prehistoric culture waves from Asia to America. 1.

JOHNSON, ELLIS A. *Scattering of light from a modulated searchlight beam at high altitudes. 401.

KEARNEY, T. H. See F. J. HERMANN. 217.

KENG, Y. L. *Oxytenanthera felix*, a new species of bamboo from Yunnan, China. 425.

KENT, GEORGE C., JR. A new trematode from *Siren lacertina: Diplostomulum sirenis*, n. sp. 87.

KIRK, EDWIN. Seven new genera of Carboniferous Crinoidea Inadunata. 321.

LEE, F. W. *Some problems in geophysics. 410.

LEONARD, E. C. Two new genera of Acanthaceae from Guatemala. 501.

LOHMAN, M. L. *Atropellis* species from pine cankers in the United States. 255.

LOWELL, W. P., JR. *Practical application of fluorescent lighting. 409.

LUNN, W. M., D. E. BROWN, J. E. MCMURTREY, and W. W. GARNER. *Tobacco and weeds. 319.

LYON, T. C. *Methods of air navigation and aeronautical charts. 406.

MARTIN, G. W. Spore formation in *Matula*. 378.

MARTIN, J. H. *Cleaning 20 million bushels of seed grain. 320.

MARTON, L. *Electron microscopy. 409.

MCMURTREY, J. E. See W. M. LUNN. 319.

MCNISH, A. G. *The geomagnetic field and its variations. 407.

MERTIE, J. B., JR. Placer gold in Alaska. 93.

——— *Stratigraphic measurements in parallel folds. 492.

MOORE, J. PERCY. *Austrobdella anoculata*, a new species of fish leech from Greenland. 520.

MORAN, E. A., R. R. BRIESE, and J. F. COUCH. Some new cyanogenetic plants. 237.

MORGAN, H. R. *The motions of the earth. 406.

MORGAN, JUANITA. See R. E. COKER. 395.

MURATA, K. J. *Volcanic ash as a source of silica for the silicification of wood. 496.

NADAI, A. *Formation of surfaces of slip under plastic states of stress. 399.

NORGORDEN, OSCAR. *Propagation characteristics of ultra-high radio frequencies. 411.

NUTTING, P. G. A study of the association of magnesia with silica in a pure magnesium clay. 233.

PEEBLES, ROBERT H., and LOUIS C. WHEELER. Arizona plants: A new variety and new names and combinations. 473.

——— See F. J. HERMANN. 217.

PFUND, A. H. *A partial analysis of gaseous mixtures without the use of a spectroscope. 407.

PHILLIPS, MAX. Anselme Payen, distinguished French chemist and pioneer investigator of the chemistry of lignin. 65.

REHDER, HARALD A. A new urocoptid mollusk from Mexico. 315.

ROTHSCHILD, MIRIAM. *Cercaria pricei*, a new trematode, with remarks on the specific characters of the "Prima" group of Xiphidiocercariae. 437.

SAUNDERS, H. E. *The David W. Taylor Model Basin at Carderock, Md. 399.

SAYLOR, LAWRENCE W. Ten new West Indian scarab beetles of the genus *Phyllophaga*, with two new names. 305.

SHEPARD, F. P. *Nondepositional environments off the California coast. 486.

SHOEMAKER, CLARENCE R. Notes on the amphipod *Gammarus minor* Say and description of a new variety, *Gammarus minus* var. *tenuipes*. 388.

SIMPSON, GEORGE GAYLORD. Mammals and land bridges. 137.

SMITH, HUGH M. The remora *Phtheirichthys lineatus* and the first specimen from United States waters. 531.

SMITH, P. A. *Exploring the continental shelves and slopes. 405.

STEPHENSON, E. L. *The results of magnetometer surveys on laccoliths in the Highwood Mountains, Mont. 488.

STEWART, T. D. The finding of an Indian ossuary on the York River in Virginia. 356.

SULLIVAN, M. X. See EDWARD L. EVERITT. 125, 457.

SWALLEN, JASON R. Eight new species of *Pariana*. 71.

——— Miscellaneous new American grasses. 209.

SWARTZ, J. H. *Resistivity studies of some geological problems. 410.

SWINGLE, WALTER T. New varieties and new combinations in the genera *Clausena*, *Ozanthera*, and *Triphasia* of the orange subfamily, Aurantioideae. 79.

THOM, CHARLES. Naming molds. 49.

THORNE, GERALD. The hairworm, *Gordius robustus* Leidy, as a parasite of the Mormon cricket, *Anabrus simplex* Haldeman. 219.

UREY, HAROLD C. The separation of isotopes by chemical means. 277.

VHAY, J. S. *Structural features on the north side of the Beartooth Mountains near Nye, Mont. 490.

WALTON, A. C. The nematode genus *Raillietnema* Travassos, 1927. 474.

WATTS, C. B. *A traveling-wire micrometer with photographic registration. 407.

WELLMAN, F. L. *Variability studies in the tomato *Fusarium* wilt organism; pathogenicity studies. 453.

WELLS, JOHN W. Two new corals from the Avenal formation (Eocene) of California. 374.

WENZEL, RUPERT L. A genus of histerid beetles new to the United States. 516.

WHEELER, LOUIS C. See ROBERT H. PEEBLES. 473.

WHEELER, NANCY H. The North American empoascan leafhoppers of the *alboneura* group (Homoptera-Cicadellidae). 478.

ZABEL, R. M. *Fundamentals of fluorescence. 408.

Aeronautics. *Methods of air navigation and aeronautical charts. T. C. LYON. 406.

Agriculture. *Cleaning 20 million bushels of seed grain. J. H. MARTIN. 320.

*Tobacco and weeds. W. M. LUNN, D. E. BROWN, J. E. MCMURTREY, and W. W. GARNER. 319.

Anthropology. Prehistoric culture waves from Asia to America. DIAMOND JENNESS. 1.

The finding of an Indian ossuary on the York River in Virginia. T. D. STEWART. 356.

Biochemistry. The bacteriostatic and the bactericidal action of certain organic sulphur compounds. EDWARD L. EVERITT and M. X. SULLIVAN. 457.

The fungistatic and fungicidal action of certain organic sulphur compounds. EDWARD L. EVERITT and M. X. SULLIVAN. 125.

Biophysics. *Determination of cell structure by means of the ultraviolet microscope. P. A. COLE. 405.

*Spectroscopic methods and their importance in biological research. F. S. BRACKETT. 404.

Botany. *An early American botanist, John Bartram 1699–1777. M. THOMAS BARTRAM. 454.

Arizona plants: A new variety and new names and combinations. ROBERT H. PEEBLES and LOUIS C. WHEELER. 473.

Arizona plants: New species, varieties, and combinations. F. J. HERMANN, T. H. KEARNEY, and R. H. PEEBLES. 217.

A second note on Georgia Discomycetes. EDITH K. CASH. 299.

Atropellis species from pine cankers in the United States. M. L. LOHMAN and EDITH K. CASH. 255.

Aublet the botanist, a pioneer against slavery, with a memorial genus of palms. O. F. COOK. 294.

*Botanical exploration in the Canadian Arctics. ARTHENE DU TILLY. 452.

*Early American botanists, John Bannister (1650–1692), John Clayton (1686–1773), Humphrey Marshall (1722–1801). S. F. BLAKE. 454.

Eight new species of *Pariana.* JASON R. SWALLEN. 71.

*How botany advances. C. STUART GAGER. 455.

Miscellaneous new American grasses. JASON R. SWALLEN. 209.

*Mosaic of lilies. PHILLIP BRIERLY. 538.

Naming molds. CHARLES THOM. 49.

New species and new names among Arizona Asteraceae. S. F. BLAKE. 467.

New varieties and new combinations in the genera *Clausena, Oxanthera,* and *Triphasia* of the orange subfamily, Aurantioideae. WALTER T. SWINGLE. 79.

Nomenclatorial note on *Pseudoperonospora.* G. R. HOERNER. 133.

Oxytenanthera felix, a new species of bamboo from Yunnan, China. Y. L. KENG. 425.

Spore formation in *Matula.* G. W. MARTIN. 378.

Taxonomic relationships in the genus *Gossypium.* S. C. HARLAND. 426.

The botany and history of *Zizania aquatica* L. ("wild rice"). CHARLES E. CHAMBLISS. 185.

*The sexual process in the rust fungi. A. H. REGINALD BULLER. 454.

The wild bean *Phaseolus polystachyus* (L.) B. S. P.: Its chromosome number. H. A. ALLARD and H. F. ALLARD. 335.

Three fungi destructive to free-living terricolous nematodes. CHARLES DRECHSLER. 240.

Two new genera of Acanthaceae from Guatemala. E. C. LEONARD. 501.

Two new North American species of *Vitis*. J. L. FENNELL. 15.

Two new species of *Muhlenbergia*. CHARLOTTE O. GOODDING. 19.

*Variability studies in the tomato *Fusarium* wilt organism; cultural studies. DOROTHY BLAISDELL. 452.

*Variability studies in the tomato *Fusarium* wilt organism; pathogenicity studies. F. L. WELLMAN. 453.

*Western American alpine plants. IRA N. GABRIELSON. 453.

Chemistry. Anselme Payen, distinguished French chemist and pioneer investigator of the chemistry of lignin. MAX PHILLIPS. 65.

A study of the association of magnesia with silica in a pure magnesium clay. P. G. NUTTING. 233.

Cyanogenesis and enzyme activity in sorghum varieties. JAMES F. COUCH and REINHOLD R. BRIESE. 413.

Some new cyanogenetic plants. E. A. MORAN, R. R. BRIESE, and J. F. COUCH. 237.

The separation of isotopes by chemical means. HAROLD C. UREY. 277.

Ecology. *Effect of epidemic tree diseases on the food supplies of wildlife. G. F. GRAVATT. 451.

Entomology. A genus of histerid beetles new to the United States. RUPERT L. WENZEL. 516.

New genera and species of ladybeetles related to *Serangium* Blackburn (Coleoptera: Coccinellidae). EDWARD A. CHAPIN. 263.

Siphonaptera from Western United States. IRVING FOX. 272.

Some new species of Syrphidae (Diptera). FRANK M. HULL. 432.

Ten new West Indian scarab beetles of the genus *Phyllophaga*, with two new names. LAWRENCE W. SAYLOR. 305.

The North American empoascan leafhoppers of the *alboneura* group (Homoptera-Cicadellidae). NANCY H. WHEELER. 478.

The oviposition habits of the Eucharidae (Hymenoptera). CURTIS P. CLAUSEN. 504.

Geochemistry. *Geochemical relations of ground waters in the Houston-Galveston area, Tex. MARGARET D. FOSTER. 490.

*Volcanic ash as a source of silica for the silicification of wood. K. J. MURATA. 496.

*Water analyses. W. D. COLLINS. 496.

Geology. *Convection currents and mountain-building. DAVID GRIGGS. 494.

*Displacement along the Hurricane fault in Utah and Arizona. LOUIS S. GARDNER. 492.

New formation names to be used in the Kingston Range, Ivanpah quadrangle, California. D. F. HEWETT. 239.

*Nondepositional environments off the California coast. F. P. SHEPARD. 486.

Placer gold in Alaska. J. B. MERTIE, JR. 93.

*Stratigraphic measurements in parallel folds. J. B. MERTIE, JR. 492.

*Structure and motion of cirque glaciers. JAMES L. DYSON. 489.

*Structural features on the north side of the Beartooth Mountains near Nye, Mont. J. S. VHAY. 490.

*The results of magnetometer surveys on laccoliths in the Highwood Mountains, Mont. E. L. STEPHENSON. 488.

Geophysics. *Exploring the continental shelves and slopes. P. A. SMITH. 405.

*Geysers and other hotsprings in Iceland. T. F. W. BARTH. 398.

*Resistivity studies of some geological problems. J. H. SWARTZ. 410.

*Some problems in geophysics. F. W. LEE. 410.

*The geomagnetic field and its variations. A. G. MCNISH. 407.

*The motions of the earth. H. R. MORGAN. 406.
*Thermal activity in Iceland. TOM F. W. BARTH. 497.
Ichthyology. *Hadropterus palmaris*, a new darter from the Alabama River System. REEVE M. BAILEY. 524.
The remora *Phtheirichthys lineatus* and the first specimen from United States waters. HUGH M. SMITH. 531.
Malacology. A new urocoptid mollusk from Mexico. HARALD A. REHDER. 315.
Mycology. A ringworm disease of muskrats transferable to man. VERA K. CHARLES. 338.
Obituary. ADLER, CYRUS. 412.
CUSHING, HARVEY WILLIAMS. 136.
FOWLE, FREDERICK EUGENE. 539.
GROOVER, THOMAS ALLEN. 455.
HAGNER, FRANCIS RANDALL. 539.
LINDGREN, WALDEMAR. 92.
MATSON, GEORGE CHARLTON. 184.
MOTTIER, DAVID MYERS. 499.
TRYON, FREDERICK GALE. 232.
Ornithology. The starling's family life and behaviors. H. A. ALLARD. 34.
Paleobotany. A *Cusparia* from the Pliocene of trans-Andean Bolivia. EDWARD W. BERRY. 464.
Additions to the Pensauken flora. EDWARD W. BERRY. 132.
A bracket fungus from the late Tertiary of southwestern Idaho. ROLAND W. BROWN. 422.
New species and changes of name in some American fossil floras. ROLAND W. BROWN. 344.
The Pliocene Esmeralda flora of west-central Nevada. DANIEL I. AXELROD. 163.
*The stratigraphic significance of the flora of the type Lance formation. ERLING DORF. 486.
Paleontology. A new *Gisortia*. WILLIAM M. INGRAM. 376.
Fossil pearls from the Colorado group of western Kansas. ROLAND W. BROWN. 365.
Mammals and land bridges. GEORGE GAYLORD SIMPSON. 137
Paralbula, a new fossil fish based on dental plates from the Eocene and Miocene of Maryland. S. F. BLAKE. 205.
Seven new genera of Carboniferous Crinoidea Inadunata. EDWIN KIRK. 321.
Two new corals from the Avenal formation (Eocene) of California. JOHN W. WELLS. 374.
Physical chemistry. *A partial analysis of gaseous mixtures without the use of a spectroscope. A. H. PFUND. 407.
Physics. *A traveling-wire micrometer with photographic registration. C. B. WATTS. 407.
*Beam power tubes as ultra-high radio frequency generators. JOHN P. HAGEN. 411.
*Electron microscopy. L. MARTON. 409.
*Fluctuations of the earth's outer atmosphere during a great magnetic storm. L. V. BERKNER. 400.
*Formation of surfaces of slip under plastic states of stress. A. NADAI. 399.
*Fundamentals of fluorescence. R. M. ZABEL. 408.
*Model testing at the National Hydraulic Laboratory. K. H. BEIJ. 399.
*Practical application of fluorescent lighting. W. P. LOWELL, JR. 409.
*Propagation characteristics of ultra-high radio frequencies. OSCAR NORGORDEN. 411.
*Scattering of light from a modulated searchlight beam at high altitudes. ELLIS A. JOHNSON. 401.
*Supersonics in liquids. FRANCIS E. FOX. 402.
*The David W. Taylor Model Basin at Carderock, Md. H. E. SAUNDERS. 399.
*Ultrasonics and the ratio of specific heat of gases. J. C. HUBBARD. 401.

*Uncertainties in atomic and common life. G. GAMOW. 403.
Scientific notes and news. 135, 232.
Zoology. Actiniaria from Alaska and Arctic waters. OSKAR CARLGREN. 21.
A new harpacticoid copepod from North Carolina. R. E. COKER and JUANITA MORGAN. 395.
A new pycnogonid from Pescadero, Calif., and distributional notes on other species. JOEL W. HEDGPETH. 84.
Austrobdella anoculata, a new species of fish leech from Greenland. J. PERCY MOORE. 520.
A new species of phyllopod crustacean from Stone Mountain, Georgia. EDWIN P. CREASER. 435.
A new trematode from *Siren lacertina: Diplostomulum sirenis*, n. sp. GEORGE C. KENT, JR. 87.
Boccardia proboscidea, a new species of spionid worm from California. OLGA HARTMAN. 382.
Cercaria pricei, a new trematode, with remarks on the specific characters of the "Prima" group of Xiphidiocercariae. MIRIAM ROTHSCHILD. 437.
Notes on the amphipod *Gammarus minus* Say and description of a new variety, *Gammarus minus* var. *tenuipes*. CLARENCE R. SHOEMAKER. 388.
Notes on the morphology of *Macrostomum ruebushi* var. *schmitti*. WAYLAND J. HAYES, JR., and FREDERICK F. FERGUSON. 27.
Studies on the egg-laying habits of the fairy shrimp. JOHN LAWRENCE AVERY. 31.
The hairworm, *Gordius robustus* Leidy, as a parasite of the Mormon cricket, *Anabrus simplex* Haldeman. GERALD THORNE. 219.
The nematode genus *Raillietnema* Travassos, 1927. A. C. WALTON. 474.

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